

2-m FM HANDHELD TRANSCEIVER

TH-25A/AT/E

SERVICE MANUAL

KENWOOD

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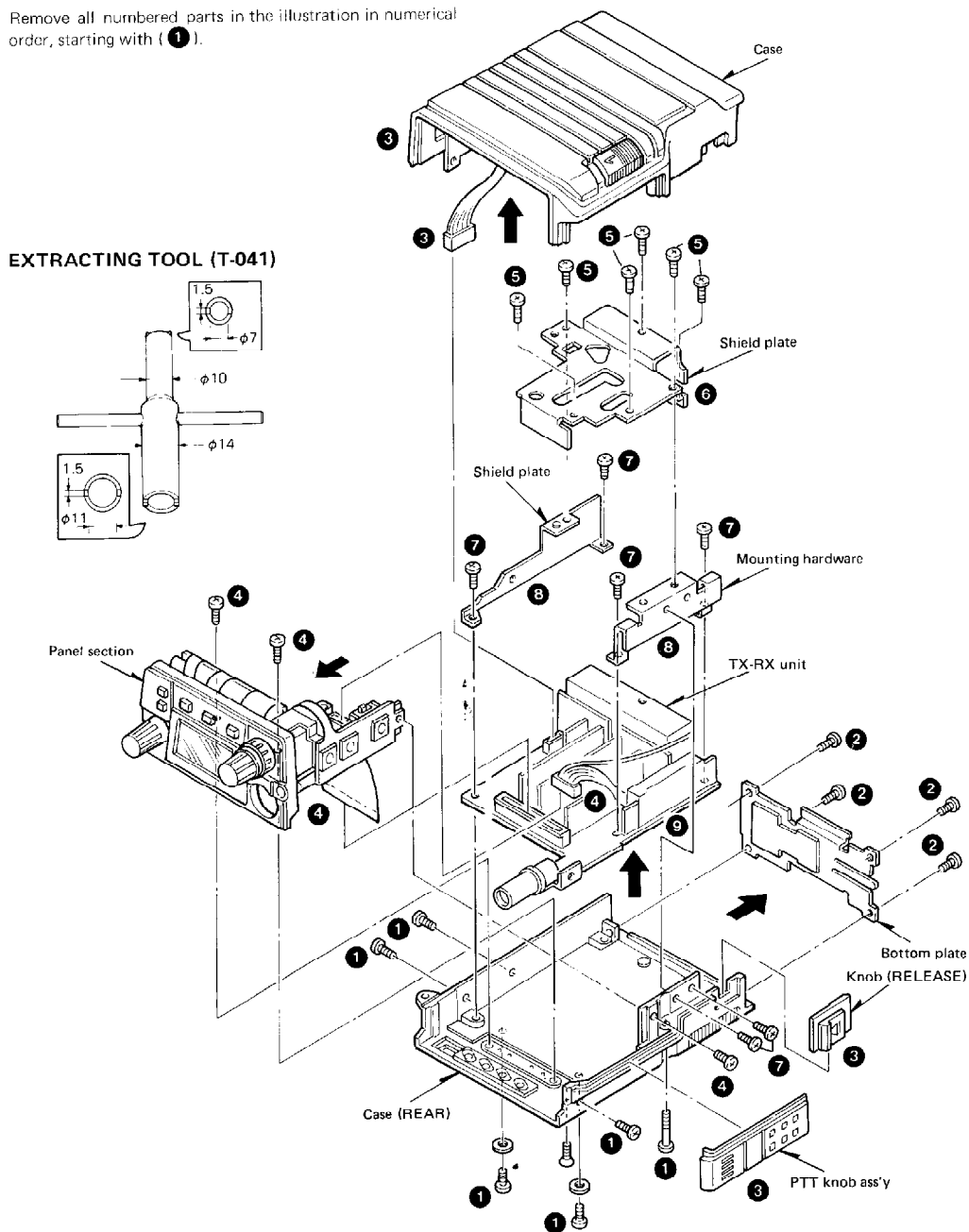
Photo is TH-25AT.

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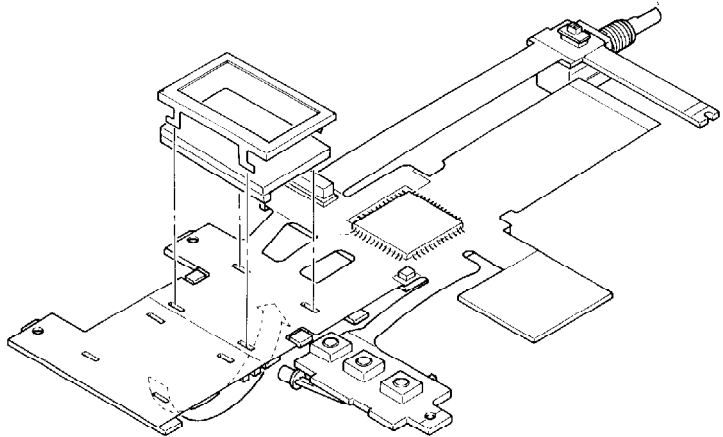
DISASSEMBLY FOR REPAIR

Remove all numbered parts in the illustration in numerical order, starting with (1).



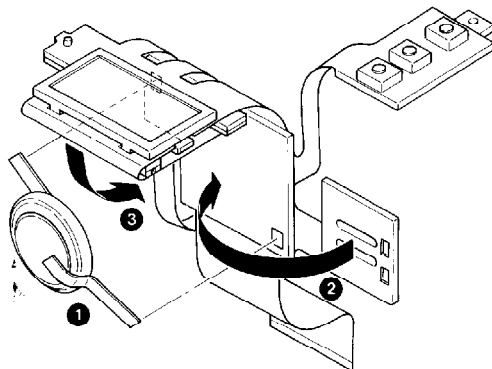
DISASSEMBLY FOR REPAIR

1. Attaching the LCD panel



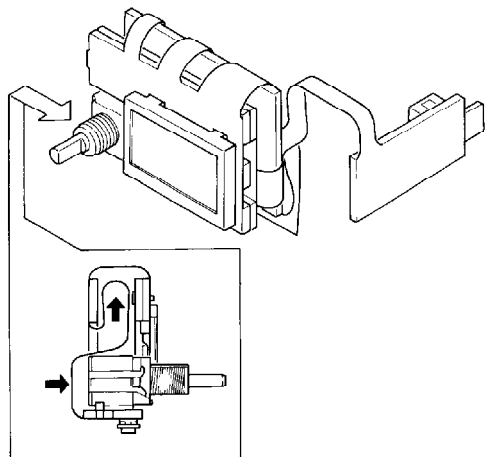
2. Assembling the FPC

1. Attach the lithium battery (1).
2. Fold the section (2) (2).
3. Fold the LCD panel (3).



3. Folding the flexible PC board

1. When attaching the encoder with the flexible cable connected to it, fold the flexible PC board about it as shown in the illustration.



CIRCUIT DESCRIPTION

FREQUENCY CONFIGURATION

The TH-25 utilizes a PLL synthesizer system and digital VFO. The VFO is capable of tuning in 5kHz and 10kHz steps, or 5kHz and 12.5kHz steps.

The receiver system configuration is based upon double super-heterodyne principles with a first intermediate frequency (IF) of 16.9MHz and a second intermediate frequency of 455kHz.

Incoming signals from the antenna are mixed with the first local oscillator signal to produce the first intermediate frequency of 16.9MHz. The first intermediate frequency is then mixed with the second local oscillator signal of 17.355 MHz to produce the second intermediate frequency of 455kHz.

Transmitter signals are generated by the PLL VCO then amplified and applied directly to the antenna circuit.

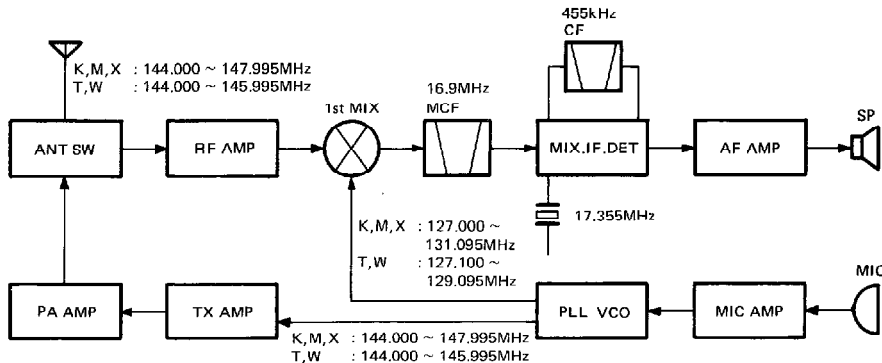


Fig. 1 Frequency configuration

RECEIVER SYSTEM

• General

Incoming signals from the antenna pass through a low-pass filter circuit and enter the front end circuits. The signals are amplified by a cascode amplifier Q1 : 2SC3937 and Q2 : 2SC4215(Y). Undesired signals are removed by a 3-pole tuning circuit utilizing variable capacitance diodes. The resulting signal is mixed with a signal from the PLL VCO by Q3 : 2SK302(Y) in the receiver front-end unit to produce the first intermediate frequency of 16.9MHz. The signal passes through the second monolithic crystal filter (MCF) to provide additional undesirable signal rejection. The signal passing through the MCF then enters IC1 : TK10487MT1 (B,C), in the IF unit, where it is combined with the second local oscillator signal to produce the second intermediate frequency of 455kHz. The 455kHz intermediate frequency signal passes through a ceramic filter (CF1), and then reenters IC1 for additional amplification and demodulation. The output of IC1 is amplified by an AF (Audio Frequency) amplifier IC1 : NJM386BM and applied to the speaker.

Item	Rating
Noninal center frequency (fo)	16.900kHz
Pass bandwidth	fo ± 7.5kHz or more at 3dB
Attenuation bandwidth	fo ± 25kHz or less at 40dB fo ± 45kHz or less at 60dB
Guaranteed attenuation	70dB or more within fo ± 1MHz Scurious : 40dB or more at fo ~ fo + 500kHz, 80dB or more within ± 890 ~ 930kHz
Ripple	1.0dB or less
Insertion loss	2.0dB or less
Terminal impedance	1.8kΩ/0pF

Table 1 MCF (L71-0276-05) (TX-RX unit XF1, XF2)

Item	Rating
Center frequency of 6dB bandwidth (fo)	455kHz ± 1.5kHz
6dB bandwidth	± 7.5kHz or more
40dB bandwidth	± 15kHz or less
Ripple	1.5dB or less (455kHz ± 1.5kHz)
Guaranteed attenuation	27dB or more within fo ± 100kHz
Insertion loss	6dB or less
Terminal impedance	1.5kΩ

Table 2 Ceramic filter (L72-0362-05) (IF unit CF1)

CIRCUIT DESCRIPTION

• Squelch and Mute Circuit

This unit has the T.ALT (Tone Alert) function to produce two muting signals. When a signal is received while the T.ALT function is ON, only a beep will sound.

The microprocessor determines the current condition and provides muting signals MU1 and MU2 as necessary. The conditions required for mute operation are listed in the following table 3. When the microprocessor provides a logic high signal level, muting occurs.

Condition			MU1	MU2
Transmission			H	H
Reception	Normal operation	When Squelch is ON	H	H
		When Squelch is OFF	L	L
	T.ALT operation	Waiting for Signal	H	H
		Signal is Received (T.ALT operating)	L	H

Muted when the level is a logic "H".

Table 3 Muting conditions

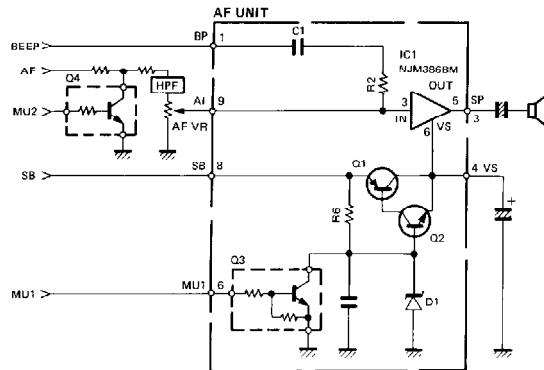


Fig. 2 Mute circuit

• S Meter Circuit

The signal used to drive the S-meter is provided from pin 12 by detecting the output from IF amplifier IC1 : TK 10487MT1(B,C). This signal is routed directly to pin 14 of the microprocessor and is used to control the S meter section of the LCD (Liquid Crystal Display). The indicators operate in pairs, thus providing six signal level indications.

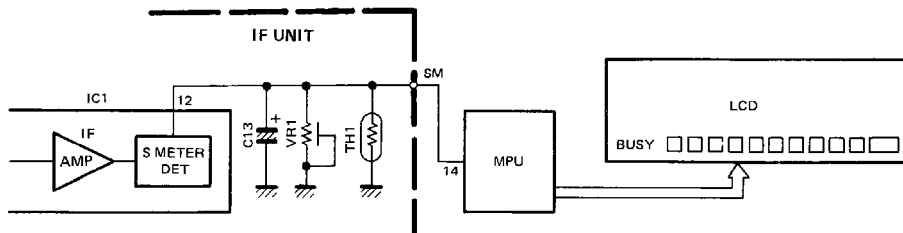


Fig. 3 S-meter circuit

CIRCUIT DESCRIPTION

TRANSMITTER SYSTEM

• General

Transmitter frequencies are obtained by generating the desired signals in the PLL (Phase Locked Loop) circuit.

Frequencies are directly modulated by using the microphone input to vary the voltage applied to the varactor diodes in the VCO (Voltage Controlled Oscillator) circuit.

The output from the VCO circuit is amplified and then applied to the driver and RF power module circuitry where the signal is amplified to the required level for transmission.

• Modulation Circuit

The signal from the microphone enters the MIC amplifier unit where it is amplified and then applied to a limiting amplifier. This signal is then applied to a splatter filter and

the microphone gain control VR1. The signal from the microphone gain control is then applied to the MOD pin where it enters the PLL VCO unit. The signal is then applied to the VCO varicap diode D2 : MA344B in order to obtain the modulated transmit signal.

This method of modulation provides variable reactance phase modulation of the transmitter frequency.

The DIMF (Dual Tone Multi Frequency) signal (option) is fed to the DIMF pin of the MIC amplifier unit. The 1750 Hz tone is supplied from the MPU and applied to pin T1 (Tone Input) of the microphone amplifier unit. This signal is filtered by a 1750Hz LPF (Low Pass Filter).

These signals are processed and routed in the same manner as the microphone signal itself.

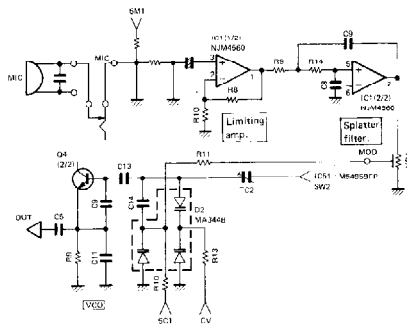


Fig. 4 Modulation circuit

• Drive and Final Circuits

The modulated signal from the VCO enters the drive unit, passes through transmit/receive switch D1 and amplified to approximately +20dBm. The APC (Automatic Power Control) control voltage is used to vary the collector voltage of the driver transistor Q2 : 2SC2954, and thus assure a clean signal. The output from the driver is further amplified by the RF power module, IC1 : M5796MA, and then supplied to the ANT connections through the antenna switching circuit composed of D1 and D2.

• APC Circuit

The APC circuit has been provided to supply transmit power stabilization. This circuit is operated by detecting the collector current of the final module by sensing the voltage drop across R4 : 0.22Ω. The comparator IC1 : LM301AD compares this voltage with a 3.9V reference voltage from zener diode D1 : 02CZ3.9YZ and voltage dividers VR1, VR2, and R9. The comparator output is applied to Q1 : 2SA1162(Y) which applies the control voltage to the collector of Q2 in the driver module.

This operation keeps the input power of the final module constant and provides a stable output. Additionally it can be used to limit, somewhat, the current of the final module caused by load variations.

• Hi/Low Switching Circuit

The TH-25 has a transmit power selection switch that allows selection of 5W (with 12V power) in the high power setting and 0.5W in the low power setting. The data from this switch is used to control the output of the drive unit by changing the ratio of the voltage generated by D1, by turning APC unit Q1 : 2SA1162(Y) on and off, and also by changing the input voltage to the comparator.

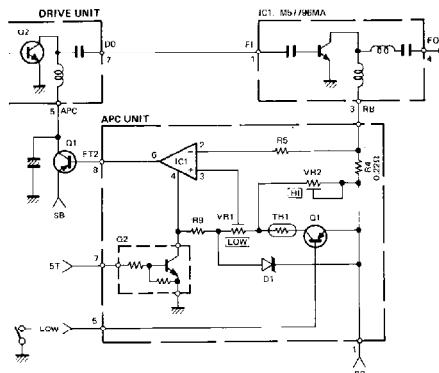


Fig. 5 APC and HI/LOW switching circuit

CIRCUIT DESCRIPTION

POWER SUPPLY CIRCUIT

The TH-25 generates a common supply voltage SB which is used to provide; 5V (5T) for transmission, 5V (5R) for reception, 5V (5C) common transmit/receive voltage, and 5V (5M) for the microprocessor and MIC.

5T and 5R are switched by a signal from the TX terminal. During transmission, microprocessor pin 29 is at a "L" level, so that Qb : 2SB1218 and Q2 : 2SA1313(Y) go ON and the 5C voltage is output at the 5T terminal. During

reception, microprocessor pin 29 is at a "H" level (open), so that Q1 : 2SD1819 and Q3 : UN5119 go ON and the 5C voltage is output at the 5R terminal.

The normal 5C voltage is generated by a three terminal regulator IC1 : LP2950CZ, differential amplifier IC2 : IMX1 and Q3 : 2SB1182(Q), which is located off of the AVR unit.

The output from the 3 terminal regulator (IC1) is used as the bias voltage for the microprocessor and MIC.

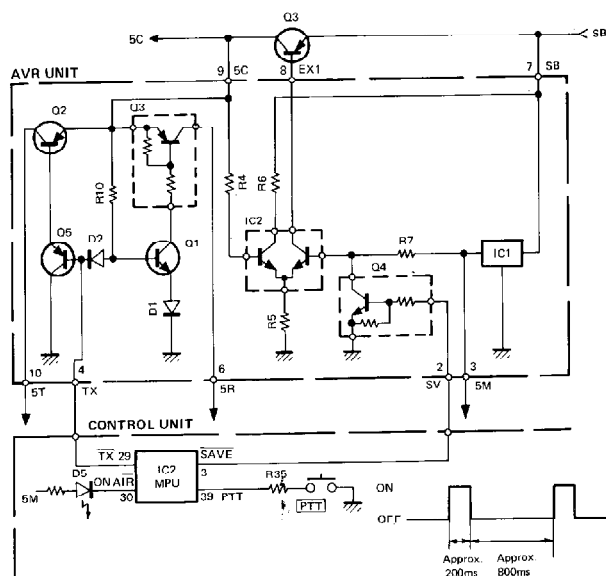


Fig. 6 Power supply circuit

• Battery Saver and Automatic Power OFF

The battery saver and automatic power off functions are provided to conserve on battery consumption when the system is waiting for an incoming signal. The battery saver and automatic power off operations are controlled by control signals from the SAVE pin 3 of the MPU : μ PD 75108AG according to the appropriate conditions at that time.

When this signal is applied all DC power except the 5V : 5M used for the MPU and MIC are turned off. The save function alternates between normal DC voltage and the save condition based upon an 200m second on and 800m second off ratio, i.e. normal voltages for 200m second and 800m second MPU and MIC only voltages.

During the period the automatic power off function is active the 5C voltages are switched OFF to reduce the effective battery drain to approximately 6mA. This circuit will activate if no signal is received for 59 minutes. At this point the microprocessor will cause a 5 second audio tone to sound. One minute after this alert signal sounds the 5C voltages will turn off.

	Save operation	Power OFF operation
Operation starting time	Squelch closes for 10 seconds or more, and no key operation is possible.	Squelch closes for 60 minutes or more, and no key operation is possible. (A beep sounds for 5 seconds after 59 minutes.)
Reset Method	Receive a signal, open squelch, or perform key operation.	Press the MONI key, or turn the power switch ON again.
Display	Normal	

Table 4 Save and power off operation condition

CIRCUIT DESCRIPTION

PLL SYNTHESIZER

The TH-25 utilizes a VCO circuit design in which the transmit and receive sections are independent of each other. The two do make use of common LPF and PLL sections, however.

Comparison frequencies of 5kHz or 6.25kHz are used and correspond to the frequency steps of 5/10kHz or 5/12.5kHz respectively. The 12.8MHz reference oscillator frequency is divided into 1/2560 or 1/2048 to produce the 5kHz and 6.25kHz. The desired transmit and receive VCO frequencies are generated directly by the respective VCO. The transmit/receive signal is sent from pin 10 (SW1) of IC51 : M54959FP. The VCO output signals are sent to the drive unit, and applied to the PLL IC (IC51) simultaneously. This single-chip IC incorporate two modulus prescalers of 1/128 and 1/129, and is arranged in a pulse swallow type of configuration.

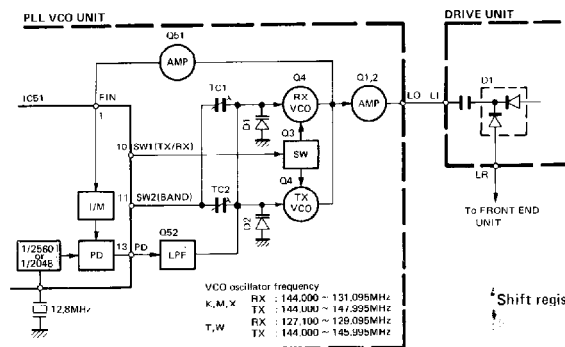


Fig. 7 PLL block diagram

MICROPROCESSOR & PERIPHERAL CIRCUITS

• Tone Alert Function (T.ALT)

The T.ALT function sounds a beep and flashes a bell display for 5 seconds to indicate that an incoming signal has been received. When the microprocessor detects that the T.ALT switch has been depressed (S2, I1) it causes a logic "H" to be applied to terminals MU1 and MU2.

The MU1 signal is used to turn the AF amplifier power (VS) off, and the MU2 signal is used to drop the input signal of the AF amplifier to ground by switching transistor Q4 : DTC143TU.

When an incoming signal from the antenna is received, the SC pin of the IF unit switches from a logic "H" to a logic "L". This informs the MPU BUSY pin that a signal has been received at the antenna terminal. When the microprocessor detects this signal it causes MU1 to go "L" which turns the AF amplifiers on.

While this is occurring a beep tone is generated by the microprocessor and is transmitted to the AF amplifier via the BEEP terminal of the microprocessor and then applied to the speaker.

This IC also contains the phase comparator. The output of the comparator is applied through an active low-pass filter, Q52 : XN6501, and is applied to the varicap diode D2 : MA344B of the VCO circuit.

The PLL division ratio and frequency are expressed by the following equation :

$$\text{General division ratio } M = A + 128N$$

Where

A : Swallow counter division ratio

N : Main counter division ratio

The values of A and N are received from the microprocessor as serial data. The values of A and N used for transmit are different from those used for receive. Therefore, the general division ratio M for transmit will be different than that of the value of M calculated for receive. This data is stored in the 21 bit shift register.

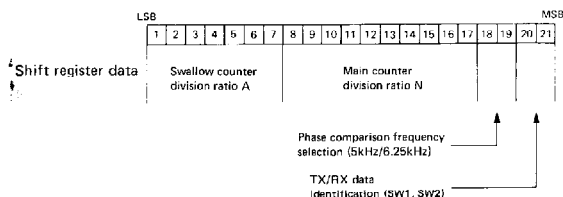


Fig. 8 PLL data configuration

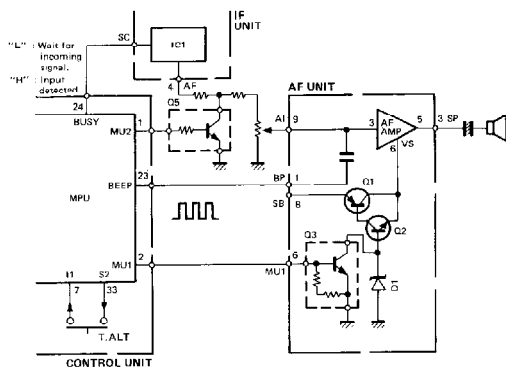


Fig. 9 T.ALT functional circuit

CIRCUIT DESCRIPTION

• Reset and Backup Circuits

Each of these operations is controlled by detecting the state of the 5M line. The microprocessor is reset by applying a pulse, generated by C1 and Q1 : 2SC2712(Y) when the power switch is pressed, to the MPU RESET pin. Backup operations are controlled when the 5M voltage drops to approximately 4.5V (4.3 thru 4.6V). When this occurs the output of IC3 : S8054ALR goes "L". This is felt on the VF pin of the microprocessor and causes the microprocessor to enter the backup mode.

When the 5M voltage increases suddenly, such as when turning on the power switch, the microprocessor will reset. When the voltage rises gradually, the leading edge of the signal supplied from IC3 will change from "L" to "H", which will also reset the microprocessor.

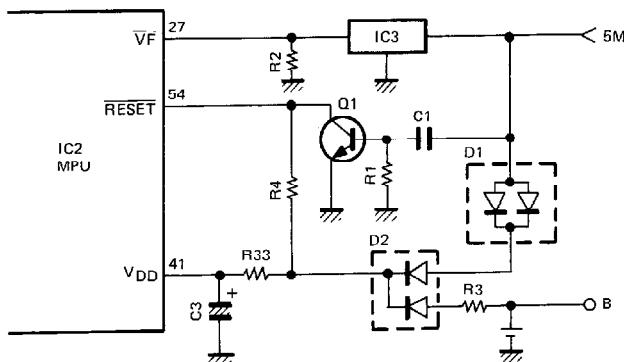


Fig. 10 Reset and backup circuit

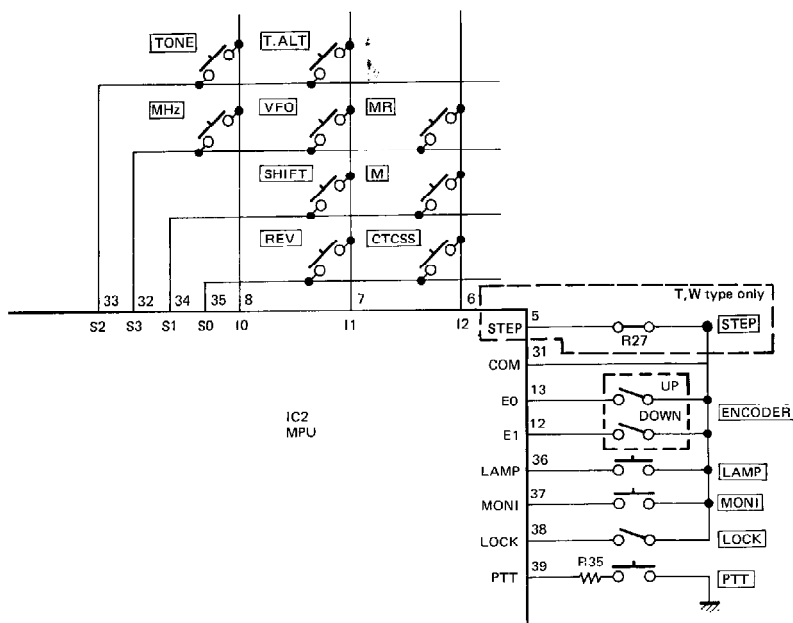
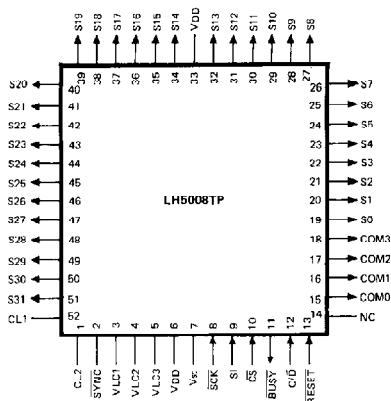


Fig. 11 Keyboard

SEMICONDUCTOR DATA

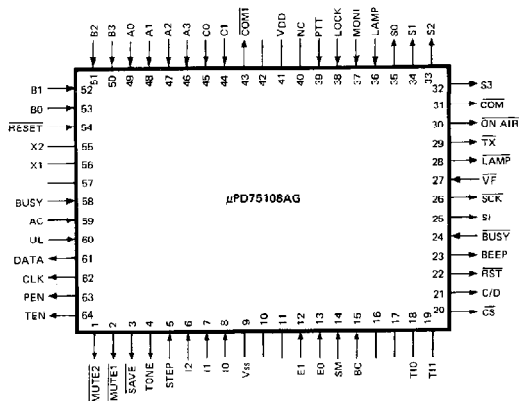
LH5008TP (Control unit IC1)

• Terminal connection diagram



μPD75108AG (Control unit IC2)

• Terminal connection diagram



• Terminal functions (LH5008TP)

Pin No.	Name	I/O	Function
1	CL2	—	Internal clock oscillation resistance pin.
2	SYNC	—	Not used.
3, 4	VLC1, VLC2	—	LCD driver power supply.
5	VLC3	—	Ground.
6	VDD	—	+5V power supply.
7	VSS	—	Ground.
8	SCK	I	Shift clock input.
9	SI	I	Serial data input.
10	CS	I	Enable input. "L" : Data input enabled. "H" : Contents of the memory are output
11	BUSY	O	Data input control. "L" : Inhibit. "H" : Permit
12	C/D	I	Input data identification input. "L" : Data. "H" : Command
13	RESET	I	Reset input.
14	NC	—	Not used.
15 ~ 17	COM0 ~ COM2	O	Common drive output.
18	COM3	O	Not used.
19 ~ 32	S0 ~ S13	O	Segment drive output.
33	VDD	—	+5V power supply.
34 ~ 45	S14 ~ S25	O	Segment drive output.
46 ~ 51	S26 ~ S31	O	Not used.
52	CL1	—	Internal clock oscillation resistance pin.

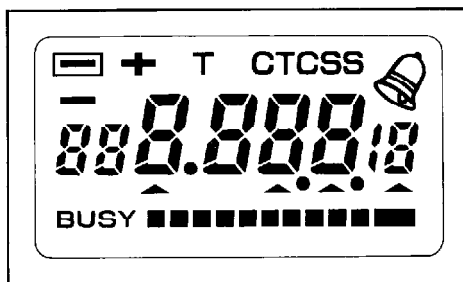
SEMICONDUCTOR DATA

• Terminal functions (μPD75108AG)

Pin No.	Name	I/O	During save	Function
1	MUT2	O	L	AF input line control. "L": ON, "H": OFF
2	MUT1	O	H	AF amplifier power control. "L": ON, "H": OFF
3	SAVE	O	H	Power save control. "L": ON, "H": OFF
4	TONE	O	L	Tone output. During transmit, 1750Hz. T, W Type
5	STEP	I	—	Step control. "L": ON, "H": OFF
6	I2	I	—	Key matrix input. M, CTCSS, MR
7	I1	I	—	Key matrix input. VFO, T, ALT, SHIFT, REV
8	I0	I	—	Key matrix input. MHz, TONE
9	Vss	—	—	Ground.
10, 11	—	—	—	Ground.
12	E1	I	—	Encoder input. DOWN
13	E0	I	—	Encoder input. UP
14	SM	I	—	S meter input.
15	BC	I	—	Battery voltage check.
16, 17	—	—	—	Ground.
18	TI0	—	—	Ground.
19	TI1	—	—	Ground.
20	CS	O	H	LCD driver control output.
21	C/D	O	H	LCD driver control output.
22	RST	O	H	LCD driver control output.
23	BEEP	O	L	Square wave output when BEEP is on.
24	BUSY	I	—	LCD driver control output.
25	SI	O	—	LCD driver control output.
26	SCK	O	—	LCD driver control output.
27	VF	I	—	Perform backup operation when the 5M voltage drops.
28	LAMP	O	H	Lamp ON/OFF control. "L": ON, "H": OFF
29	TX	O	H	Transmit/receive switching. "L": Transmit, "H": Receive
30	ON AIR	O	H	ON AIR display output. "L": ON, "H": OFF
31	COM	O	L	"L": normal, "H": during save or backup.
32	S3	O	L	Key matrix output. MHz, VFO, MR
33	S2	O	L	Key matrix output. TONE, I, ALI
34	S1	O	L	Key matrix output. M, SHIFT
35	S0	O	L	Key matrix output. CTCSS, REV
36	LAMP	I	—	Lamp switch control. "L": SW ON, "H": SW OFF
37	MONI	I	—	Monitor switch control. "L": SW ON, "H": SW OFF
38	LOCK	I	—	Lock switch control. "L": SW ON, "H": SW OFF
39	PTT	I	—	PTT switch control. "L": SW ON, "H": SW OFF
40	NC	—	—	Open.
41	VDD	—	—	+5V power supply.
42	—	—	—	Ground.
43	COM1	O	L	—
44	C1	I	H	Display switching. "L": Normal display, "H": Channel display
45	C0	I	—	VHF/UHF switching. "L": VHF, "H": UHF
46 ~ 49	A3 ~ A0	I	—	Destination.
50 ~ 53	B3 ~ B0	I	—	Destination.
54	RESET	I	—	System reset.
55	X2	—	—	—
56	X1	—	—	—
57	—	—	—	Open.
58	BUSY	I	—	Busy control. "L": Open, "H": Busy
59	AC	I	—	Tone squelch control output. "L": No match, "H": Match
60	UL	I	—	Unlock output. "L": Lock, "H": Unlock
61	DATA	O	L	PLL, TONE data.
62	CLK	O	L	PLL, TONE clock.
63	PEN	O	L	PLL enable.
64	TEN	O	L	CTCSS enable.

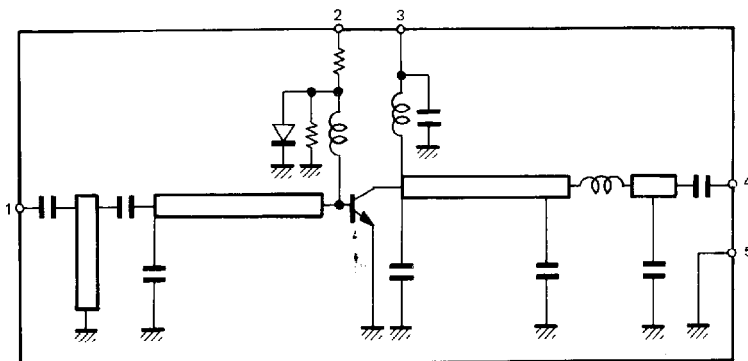
FTD8608 (Control unit LCD)

- All lighting



M57796MA (TX-RX unit IC1)

- Equivalent circuit



- 1 : Input
- 2 : Bias + B
- 3 : + B
- 4 : Output
- 5 : GND (Fin)

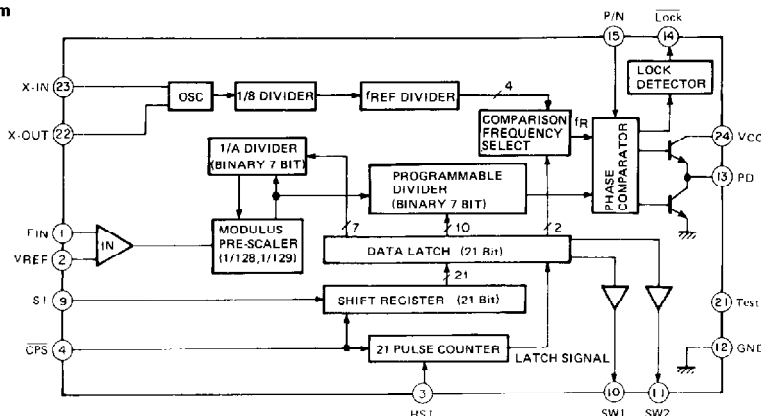
• Electrical characteristics

Item	Symbol	Rating			Unit	Condition
		MIN.	TYP.	MAX.		
Output power	P_o	7	8		W	$T_c = 25^\circ\text{C}$
Total efficiency	η_T	50	55		%	$V_{cc} = 12.5\text{V}$
2nd spurious				-20	dB	$V_{BB} = 5\text{V}$
Spurious after 3rd				-30	dB	$f = 144 \sim 148\text{MHz}$
Output SWR	ρ_{out}		1.5		-	$P_{in} = 200\text{mW}$
Input SWR	ρ_{in}		2.5		-	$Z_G = Z_L = 50\Omega$
Operating voltage	V_{cc}		16		V	

SEMICONDUCTOR DATA

M54959FP (PLL unit IC51)

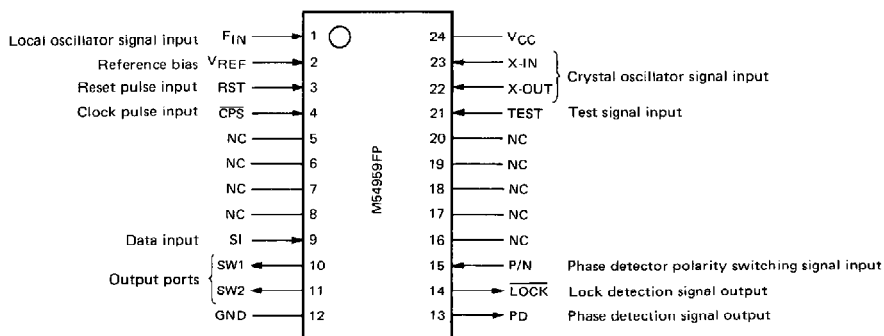
• Block diagram



• Description of terminals

No.	Symbol	Pin name	Description
1	F _{IN}	Local oscillator signal input	Local oscillator frequency (VCO) input. f _{MAX} = 500MHz.
2	V _{REF}	Reference bias	Grounded by a 1000pF capacitor.
3	RST	Reset pulse input	Reset pulse input for 21-pulse counter.
4	CPS	Clock pulse input	Clock pulse input for shift register.
5 ~ 8	NC	Not connected	Use for open or ground.
9	SI	Data input	Data input for shift register.
10	SW1	Output ports	Output ports whose status is determined by the data sent from the controller.
11	SW2	Output ports	Open collector.
12	GND	Ground	0V.
13	PD	Phase detection signal output	Tristate.
14	LOCK	Lock detection signal output	"L" when the PLL unit is locked, "H" when it is unlocked. Open collector.
15	P/N	Phase detector polarity switching	When this pin is "H", the PD pin is "H" for phase lead and "L" for phase delay. When this pin is "L", the PD pin is "L" for phase lead and "H" for phase delay.
16 ~ 20	NC	Not connected	Use for open or ground.
21	TEST	Test signal input	Usually "L". When this pin is "H", IR (comparison frequency) and f _{N/N} (programmable divider) are output from SW1 (pin 10) and SW2 (pin 11), respectively.
22	X-OUT	Liquid crystal oscillator signal input	Inputs signals sent from the 12.8MHz basic oscillator to X-IN.
23	X-IN	Liquid crystal oscillator signal input	Oscillation is possible even when an external crystal resonator is used.
24	VCC	Power supply	4.5 ~ 5.5V

• Terminal connection diagram

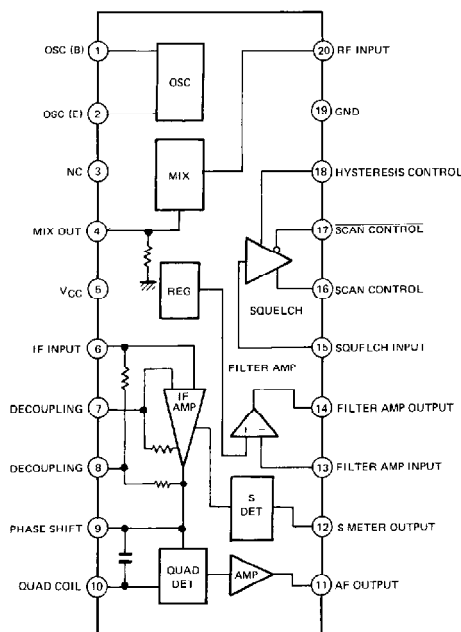


NC : Not connected

SEMICONDUCTOR DATA/DESCRIPTION OF COMPONENTS

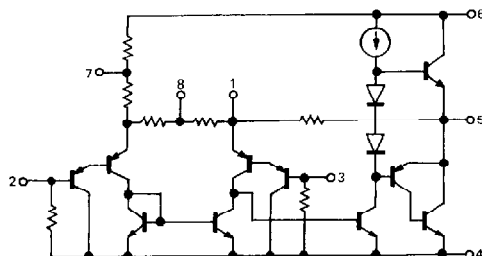
TK10487MT1 (IF unit IC1)

● Block diagram



NJM386BM (AF AMP. unit IC1)

● Equivalent circuit



● Electrical characteristics

Item	Symbol	Rating			Unit	Condition
		MIN.	TYP.	MAX.		
Supply voltage	V_s	4	—	18	V	$V_s = 9V, R_L = 8\Omega$, THD = 10% $f = 1kHz$, Between 1 and 8 : Connect capacitor (10 μ F). Between 1 and 8 : Open. $f = 1kHz$, $P_{out} = 125mW$, $R_L = 8\Omega$
Output power	P_{out}	500	850	—	mW	
Voltage gain	A_v	—	46	—	dB	
Bandwidth	BW	—	600	—	kHz	
Distortion	THD	—	0.2	—	%	
Input resistance	R_{IN}	—	50	—	k Ω	

Description of Components

TX-RX UNIT (X57-3160-XX)

Component	Part No.	Operation/Condition/Compatibility
Q1	2SB1182(O)	APC control output.
Q2	2SC2714(O)	Amplification of the second intermediate frequency of 16.9MHz.
Q3	2SB1182(Q)	5C (5V) AVR.
Q4	DTC143TU	AF mute (MU2).
Q5	DTC114EU	Switch which stops the VCO output to pin LR during transmit
Q9	DTC143TK	Mic mute.
Q101	2SC4118(GR)	300Hz HPF.
IC1	M57796MA	Power amplification.
D1	MI303	Transmit/receive switching. ON during transmit.
D2	HSK277	Transmit/receive switching. ON during transmit.
D4	DAN202U	Isolation of BY (AF amp.) from 5M.

PARTS LIST

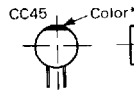
CAPACITORS

CC 45 TH 1H 220 J
1 2 3 4 5 6

- 1 = Type ceramic, electrolytic, etc.
2 = Shape round, square, etc.
3 = Temp. coefficient
4 = Voltage rating
5 = Value
6 = Tolerance

• Temperature Coefficient

1st Word	C	L	P	R	S	T	U
Color*	Black	Red	Orange	Yellow	Green	Blue	Violet
ppm/°C	0	-80	-150	220	-330	-470	-750



• Capacitor value

- 0 1 0 = 1pF
1 0 0 = 10pF
1 0 1 = 100pF
1 0 2 = 1000pF = 0.001μF

1 0 3 = 0.01μF

2 2 0 = 22pF
1st number | Multiplier
2nd number

2nd Word	C	H	J	K	L
ppm/°C	± 30	± 60	± 120	± 250	± 500

Example CC45TH = -470±60 ppm/°C

• Tolerance

Code	C	D	G	J	K	M	X	Z	P	No code
(%)	± 0.25	± 0.5	± 2	± 5	± 10	± 20	+ 40 - 20	+ 80 - 20	+ 100 - 0	10μF-10~+50 4.7μF-10~+75

Code	B	C	D	F	G
(pF)	± 0.1	± 0.25	± 0.5	± 1	± 2

Less than 10 pF

• Rating voltage

2nd word	A	B	C	D	E	F	G	H	J	K	V
1st word											
0	1.0	1.25	1.6	2.0	2.5	3.15	4.0	5.0	6.3	8.0	—
1	10	12.5	16	20	25	31.5	40	50	63	80	35
2	100	125	160	200	250	315	400	500	630	800	—
3	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	—

• Chip capacitors

(EX) CC 73 F SL 1H 000 J → Refer to the table above.
1 2 3 4 5 6 7
(Chip) (CH,RH,UJ,SL)
(EX) CK 73 F SL 1H 000 J
1 2 3 4 5 6 7
(Chip) (B,F)

Dimension

Dimension code	L	W	T
Empty	5.6 ± 0.5	5.0 ± 0.5	Less than 2.0
E	3.2 ± 0.2	1.6 ± 0.2	Less than 1.25
F	2.0 ± 0.3	1.25 ± 0.2	Less than 1.25

Dimension

Dimension code	L	W	T	Wattage
E	3.2 ± 0.2	1.6 ± 0.2	0.57	2B
F	2.0 ± 0.3	1.25 ± 0.2	0.45	2A

Rating wattage

Cord	Wattage	Cord	Wattage	Cord	Wattage
2A	1/10W	2E	1/4W	3A	1W
2B	1/8W	2H	1/2W	3D	2W
2C	1/6W				



RESISTORS

• Chip resistor (Carbon)

(EX) RD 73 E B 7B 000 J
1 2 3 4 5 6 7
(Chip) (B,F)

• Carbon resistor (Normal type)

RD 14 B 2C 000 J
1 2 3 4 5 6 7

- 1 = Type ceramic, electrolytic, etc.
2 = Shape round, square, etc.
3 = Dimension
4 = Temp. coefficient
5 = Voltage rating
6 = Value
7 = Tolerance.

Scan by Man

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TH-25A/AT/E						
1	3B	✱	A01-1038-02	METALLIC CABINET(REAR)		
4	1A	✱	A02-0836-03	PLASTIC CABINET (FRONT)		B
4	1A	✱	A02-0838-02	PLASTIC CABINET (FRONT)		A
4	1A	✱	A02-0839-02	PLASTIC CABINET (FRONT)		C
5	2B	✱	A11-0405-04	SUB CHASSIS ASSY(VSL)		
6	2B	✱	A11-0406-04	SUB CHASSIS ASSY(ENCODER)		
7	2A	✱	A20-2625-03	PANEL ASSY		
10	3B	✱	A40-0621-04	BOTTOM PLATE		
-		✱	A02-0814-13	PLASTIC CABINET		B
-		✱	A20-2630-04	PANEL		
-			A40-0622-04	BOTTOM PLATE		B
14	3B	✱	B01-0661-03	PANEL ESCUTCHEON		
15	2D	✱	B09-0309-04	CAP (SP,MIC)		
16	2A	✱	B10-0698-04	FRONT GLASS		
17	2A	✱	B11-0449-04	REFLECTOR		
18	3B	✱	B40-3747-04	MODEL NAME PLATE(BATT CASE)		B
18	3B	✱	B40-3763-04	MODEL NAME PLATE(BATT CASE)		A
18	3B	✱	B40-3764-04	MODEL NAME PLATE(BATT CASE)		C
20	3B		B42-2437-04	LABEL (SERIAL)		
22	2D	✱	B42-3325-04	LABEL		
23	1D		B46-0410-20	WARRANTY CARD	K	B
24	1D	✱	B50-8170-20	INSTRUCTION MANUAL		
-		✱	B03-0547-04	DRESSING PLATE (DTMF)		B
-			B42-2454-04	LABEL (SERIAL)		
-			B42-3301-04	LABEL	K	B
C1			CC73FCH1H390J	CHIP C 39PF J		
30	3B	✱	E04-0168-05	BNC RECEPTACLE		
31	3B	✱	E23-0494-14	TERMINAL (POWER,-)		
37	3B	✱	E23-0607-04	TERMINAL (BNC)		
-		✱	F23-0605-14	TERMINAL (POWER,+)		
-		✱	E31-3279-25	CONNECTING WIRE(CTCSS)		
-		✱	E31-3332-05	CONNECTING WIRE(TX,RX-JACK)		
46	2B	✱	F10-1364-14	SHIELDING PLATE		
47	1B	✱	F10-1365-14	SHIELDING PLATE		
40	2B	✱	F11-1097-04	SHIELDING COVER(POWER MODULE)		
49	1A	✱	F19-0658-04	BLIND PLATE (MIC)		
51	3B	✱	F20-0573-14	INSULATING BOARD(TX, RX)		
52	2A	✱	F20-0574-04	INSULATING BOARD(CONTROL)		
53	1A	✱	F20-0576-04	INSULATING BOARD(JACK)		
54	3B	✱	F29-0435-05	INSULATOR (BELT HOOK)		
55	3B	✱	F20-1008-04	INSULATING BOARD(BOTTOM CASE)		
56	2B	✱	F20-1009-04	INSULATING BOARD(SHIELDING PLT)		
-			F20-0587-04	INSULATING BOARD(LITHIUM BATT)		
58	2A		G02-0505-05	SPRING (VSL, ENCODER)		
59	1A		G10-0657-04	NON-WOVEN FABRIC		A
59	1A		G10-0657-04	NON-WOVEN FABRIC		C
59	1A	✱	G10-0664-04	NON-WOVEN FABRIC		B
60	3B		G13-0852-04	CUSHION (POWER)		
62	3B	✱	G16-0514-04	SHEET		
63	1A		G53-0508-04	NON-WOVEN FABRIC		

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参照番号	位置	新	部品番号	部品名 / 規格	仕向	備考
67	3C	*	H01-8111-02	ITEM CARTON BOX		B
67	3C	*	H01-8155-02	ITEM CARTON BOX		C
67	3C	*	H01-8156-02	ITEM CARTON BOX		A
69	3D	*	H10-2635-02	POLYSTYRENE FOAMED FIXTURE		B
70	1D		H11-0808-14	POLYSTYRENE PLATE		
71	2D		H13-0801-04	PROTECTION SHEET		
72	2D	*	H13-0818-04	PROTECTION SHEET		
73	1D	*	H21-0715-04	PROTECTION SHEET		
75	2D		H25-0085-04	PROTECTION BAG (100X200)		
79	3D	*	J19-1426-03	HOLDER		
80	2B	*	J21-4219-04	MOUNTING HARDWARE (POWER MODULE)		
82	1A	*	J21-4221-04	MOUNTING HARDWARE (SPEAKER)		
83	1A	*	J21-4222-04	MOUNTING HARDWARE (SP, MIC JACK)		
85	2D	*	J29-0424-04	CLUT HOOK		
86	1A	*	J30-0547-04	SPACER (SPEAKER)		
87	1A	*	J31-0526-04	SPACER (MIC)		
88	2A	*	J69-0311-05	RING (BNC)		
89	2D	*	J69-0312-04	HAND STRAP		
90	1A	*	J21-4223-04	MOUNTING HARDWARE (CASE)		
91	1A	*	J30-0548-04	SPACER (SPEAKER)		B
		*	J99-0311-04	SHEET		
94	3A	*	K27-0499-04	KNBB (HI/LO)		
95	1B	*	K27-0500-04	KNBB (F. LOCK)		A
95	1B	*	K27-0500-04	KNBB (F. LOCK)		C
95	1B	*	K27-3001-04	KNBB (F. LOCK)		B
96	2A	*	K29-3096-04	KNBB ASSY (VOL)		
97	2A	*	K29-3097-04	KNBB ASSY (SOL)		
98	2A	*	K29-3098-04	KNBB ASSY (ENCODER)		
99	3B	*	K29-3100-04	KNBB ASSY (RELEASE)		
100	3B	*	K29-3102-03	KNBB ASSY (PTT)		
101	2A	*	K29-3103-04	KEY TSP (MHZ, M. CH)		
102	3A	*	K29-3104-04	KEY TSP (REV, M)		
103	1A	*	K29-3105-04	KEY TSP (DTMF)		B
104	2A	*	N14-0534-04	NUT (VOL, ENCODER)		
A	3B	*	N09-0663-04	SCREW		
B	3B	*	N09-2022-05	SCREW (M2X4)		
C	1A, 3B	*	N09-2023-05	SCREW (M2X3)		
D	3B	*	N09-2024-05	SCREW (2X16)		
E	3B	*	N09-2025-05	SCREW (2X3)		
F	1A	*	N09-2026-05	SCREW (2X3.5)		
G	3B	*	N09-2028-05	SCREW (M3X4)		
J	2B		N30-2005-41	PAN HEAD MACHINE SCREW		
K	3B		N33-2005-45	8VAL HEAD MACHINE SCREW		
L	1B, 2B		N35-2003-41	BINDING HEAD MACHINE SCREW		
R1			RD14BB2B333J	RD 33K J 1/BW		
111	1A	*	T07-0251-05	LOUDSPEAKER		
112	1D	*	T90-0356-05	ANTENNA		
113	1A	*	T91-0372-05	MICROPHONE		
122	3D		W09-0382-15	BATTERY CHARGER (120V)	K	B
122	3D		W09-0382-15	BATTERY CHARGER (120V)	M4	A
122	3D		W09-0364-05	BATTERY CHARGER (220V)	M	B
122	3D		W09-0364-05	BATTERY CHARGER (220V)	MM3	A

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122	3D		W09-0385-05	BATTERY CHARGER(120V)	M2	B
122	3D		W09-0385-05	BATTERY CHARGER(120V)	M2	A
122	3D		W09-0386-05	BATTERY CHARGER	X	A
122	3D		W09-0387-05	BATTERY CHARGER	T	C
122	3D		W09-0388-05	BATTERY CHARGER	W	C
123	2C		W09-0507-05	BATTERY PACK (PB-6)		
		*	W09-0394-05	LITHIUM BATTERY		
126	2A	*	X53-3080-11	CONTROL UNIT	K	B
126	2A	*	X53-3080-12	CONTROL UNIT	MM2	B
126	2A	*	X53-3080-12	CONTROL UNIT	MM2	A
126	2A	*	X53-3080-23	CONTROL UNIT	M3M4X	A
126	2A	*	X53-3080-52	CONTROL UNIT	1	C
126	2A	*	X53-3080-62	CONTROL UNIT	W	C
127	1A,2B	*	X57-3160-10	TX, RX UNIT		B
127	1A,2B	*	X57-3160-21	TX, RX UNIT		A
127	1A,2B	*	X57-3160-61	RX, RX UNIT		C
128	1A	*	X52-3090-10	SIGNALING UNIT		B
SIGNALING UNIT (X52-3090-10)						
C1			CE04CW0J100M	ELECTR 10UF	6.3WV	
C2			CK73FB1H102K	CHIP C 1000PF	K	
C3			CK73EB1E104K	CHIP C 0.10UF	K	
C4			C92-0005-05	CHIP-TAN 2.2UF	6.3WV	
C5			CK73FB1H332K	CHIP C 3300PF	K	
C6			C92-0009-05	CHIP TAN 4.7UF	10WV	
C7	.8		CK73FB1H102K	CHIP C 1000PF	K	
C9			C92-0008-05	TANTAL 3.3UF	16WV	
L1		*	L78-0035-05	RESONATOR		
R2			RK73FB2A154J	CHIP R 150K	J 1/10W	
R3			RK73FD2A122J	CHIP R 1.2K	J 1/10W	
R4			RK73FB2A563J	CHIP R 56K	J 1/10W	
R5			RK73FB2A101J	CHIP R 100	J 1/10W	
R6			RK73FB2A472J	CHIP R 4.7K	J 1/10W	
RB	.9		R92-0670-05	CHIP R 0.0HM		
VR1			R12-3460-05	TRIMMING PNT. (33K)		
IC1			LR40072	IC(TONE DIALER)		
Q1			2SC2712(GR)	CHIP TRANSISTOR		
CONTROL UNIT (X53-3080-XX)						
9	2A	*	A33-0409-04	REFLECTOR (LCD)		
C1			CK73FB1H223K	CHIP C 0.022UF	K	
C2			CK73FB1H103K	CHIP C 0.010UF	K	
C3			C92-0010-05	TANTAL 6.8UF	6.3WV	
C4			CK73FB1H102K	CHIP C 1000PF	K	
C5	-7		CK73FB1H103K	CHIP C 0.010UF	K	
C10		*	CK73GB1H102K	CHIP C 1000PF	K	
40	2A	*	E29-0478-04	LCD CONNECTOR		
B1	2A	*	J21-4220-04	MSUNTING HARDWARE(LCD)		
X1		*	L78-0036-05	RESONATOR (4.19MHZ)		
R1			RK73FB2A563J	CHIP R 56K	J 1/10W	
R2			RK73FB2A183J	CHIP R 18K	J 1/10W	

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R3			RK73FB2A333J	CHIP R 33K J 1/10W		
R4			RK73FB2A473J	CHIP R 47K J 1/10W		
R5			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R6 ,7			RK73FB2A473J	CHIP R 47K J 1/10W		
R8			RK73FB2A331J	CHIP R 330 J 1/10W		
R9			RK73FB2A562J	CHIP R 5.6K J 1/10W		
R10			RK73FB2A103J	CHIP R 10K J 1/10W		
R11 -15			RK73FB2A473J	CHIP R 47K J 1/10W		
R16			RK73FB2A184J	CHIP R 180K J 1/10W		
R17			RK73FB2A390J	CHIP R 39 J 1/10W		
R18 -22			R92-0670-05	CHIP R 0 8HM	K	
R18 -22			R92-0670-05	CHIP R 0 8HM	MM2	
R18 -22			R92-0670-05	CHIP R 0 8HM	M3M4X	
R22			R92-0670-05	CHIP R 0 8HM	T	
R22			R92-0670-05	CHIP R 0 8HM	W	
R25			R92-0670-05	CHIP R 0 8HM	K	
R25 -28			R92-0670-05	CHIP R 0 8HM	W	
R26 -28			R92-0670-05	CHIP R 0 8HM	T	
R28			R92-0670-05	CHIP R 0 8HM	M3M4X	
R31 -35			R92-0670-05	CHIP R 0 8HM		
R36			R92-0670-05	CHIP R 0 8HM	T	
R36			R92-0670-05	CHIP R 0 8HM	W	
S1 -3		*	S40-1415-05	TACT SWITCH		
S4		*	S31-1420-05	SLIDE SWITCH (F.LOCK)		
S5		*	S31-2414-05	SLIDE SWITCH (HI/LS)		
117	2A	*	FTD8608	LCD		
D1 ,2			15S184	CHIP DIODE		
D3 ,4			15S181	CHIP DIODE		
D5	2A		SLH34VC3	LED (TX)		
D6 ,7			LN01301C(Q)	LED (LCD)		
IC1		*	LH5008TP	IC(LCD CONTROLLER/ DRIVER)		
IC2			75108AG-018-22	IC(MICROPROCESSOR)	TW	
IC2			75108AG-021-22	IC(MICROPROCESSOR)	MM2	
IC2			75108AG-021-22	IC(MICROPROCESSOR)	M3M4X	
IC3			S8054ALR-LN	IC		
Q1			2SC2712(Y)	CHIP TRANSISTOR		
Q2			2SA1162(Y)	CHIP TRANSISTOR		
121	2A	*	W02-0400-05	ENCODER		
TX-RX UNIT (X57-3160-XX) -10:TH-25AT -21:TH-25A -61:TH-25E						
C1			CC73FCH1H101J	CHIP C 100PF J		
C2			C92-0005-05	CHIP-TAN 2.2UF 6.3WV		
C4			C90-2053-05	ELECTRO 47UF 6.3WV		
C5			CK73FB1H102K	CHIP C 1000PF K		
C6			C90-2053-05	ELECTRO 47UF 6.3WV		
C8			CK73FB1H102K	CHIP C 1000PF K		
C9			C90-2073-05	ELECTRO 6.8UF 16WV		
C10			CK73EF1C105Z	CHIP C 1.0UF Z		
C11			C90-2048-05	ELECTRO 6.8UF 6.3WV		
C12			CK73FB1H102K	CHIP C 1000PF K		
C13			C90-2073-05	ELECTRO 6.8UF 16WV		
C14 ,15			CK73FB1H102K	CHIP C 1000PF K		
C16			CC73FCH1H120J	CHIP C 12PF J		
C17			CC73FCH1H150J	CHIP C 15PF J		

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C18			CK73FB1H102K	CHIP C 1000PF K		
C19			CC73FCH1H220J	CHIP C 22PF J		
C20			CC73FCH1H090D	CHIP C 9.0PF D		
C21			CC73FCH1H390J	CHIP C 39PF J		
C22			CC73FCH1H040C	CHIP C 4.0PF C		
C23			CC73FCH1H180J	CHIP C 18PF J		
C24			CC73FCH1H220J	CHIP C 22PF J		
C25			CC73FCH1H200J	CHIP C 20PF J		
C26			CC73FCH1H470J	CHIP C 47PF J		
C27			CK73FB1H102K	CHIP C 1000PF K		
C28			CC73FCH1H080D	CHIP C 8.0PF D		
C29 -31			CK73FB1H102K	CHIP C 1000PF K		
C32			EE04CWOJ100M	ELECTR0 10UF 6.3WV		
C33			C90-2073-05	ELECTR0 6.8UF 16WV		
C34			C90-2050-05	ELECTR0 33UF 6.3WV		
C35			C90-2053-05	ELECTR0 47UF 6.3WV		
C36			C90-2058-05	ELECTR0 47UF 10WV		
C37			C90-2052-05	ELECTR0 68UF 10WV		
C38			C90-2049-05	ELECTR0 15UF 6.3WV		
C39 +40			CK73FB1H102K	CHIP C 1000PF K		
C41			C92-0507-05	TANTAL 4.7UF 6.3WV		
C42 +43			CK73FB1H102K	CHIP C 1000PF K		
C44			CK73FF1E154Z	CHIP C 0.15UF Z		
C45			CK73FB1H102K	CHIP C 1000PF K		
C46		*	CK73FB1E473M	CHIP C 0.047UF M		
C47 +48			CK73FB1H102K	CHIP C 1000PF K		
C51			CK73FB1H102K	CHIP C 1000PF K		
C52 -54			CC73FCH1H101J	CHIP C 100PF J		
C55			CC73FCH1H330J	CHIP C 33PF J		
C59			CK73FB1H102K	CHIP C 1000PF K		B
C60			CC73FCH1H470J	CHIP C 47PF J		
C61			CK73CD1H102K	CHIP C 1000PF K		
C101		*	CK73FB1E473M	CHIP C 0.047UF M		
C102			CK73FB1H223K	CHIP C 0.022UF K		
C103			CK73FB1E273K	CHIP C 0.027UF K		
C104			C90-0896-05	ELECTR0 47UF 16WV		
CN1			E40-5128-05	PIN CONNECTOR (20P)		
CN2			E40-5127-05	PIN CONNECTOR (7P)		
CN4			E40-5127-05	PIN CONNECTOR (7P)		
CN6			E40-5126-05	PIN CONNECTOR (7P)		
J1			E11-0421-05	PHONE JACK		
J2			E11-0420-15	PHONE JACK		
TP1 +2			E23-0464-05	TERMINAL		
W2			E31-3295-15	CONNECTING WIRE		B
W3			E31-3296-15	CONNECTING WIRE		A
W3		*	E31-3335-15	CONNECTING WIRE		C
-		*	F12-0411-04	SHIELDING PARTS(PLL)		
-		*	F20-0597-04	INSULATING BOARD(DRIVE)		
-			J30-0545-05	SPACER (X1,XF1,XF2)		
-		*	J30-0551-04	SPACER (POWER MODULE)		
L1 +2			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		

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L3			L40-1892-16	SMALL FIXED INDUCTOR(1.8UH)		
L4		*	L34-1210-05	COIL		
L5		*	L34-1224-05	COIL		
L6 ,7			L34-0893-05	COIL		
L8			L40-1892-16	SMALL FIXED INDUCTOR(1.8UH)		
L9		*	L34-4051-05	COIL		
L10			L40-1011-13	SMALL FIXED INDUCTOR(100UH)		
X1		*	L77-1357-05	CRYSTAL RESONATOR (17.355MHZ)		
X1-1 ,2		*	L71-0276-05	MCF (16.9MHZ)		
R1			RK73FB2A124J	CHIP R 120K J 1/10W		
R2			RK73FB2A151J	CHIP R 150 J 1/10W		
R3			RK73FB2A122J	CHIP R 1.2K J 1/10W		
R4			RK73FB2A334J	CHIP R 330K J 1/10W		
R5			RK73FB2A152J	CHIP R 1.5K J 1/10W		
R6			RK73FB2A473J	CHIP R 47K J 1/10W		
R7			RK73FB2A332J	CHIP R 3.3K J 1/10W		
R8 ,9			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R10			RK73FB2A182J	CHIP R 1.0K J 1/10W		
R11			RK73FB2A471J	CHIP R 470 J 1/10W		
R12			RK73FB2A100J	CHIP R 10 J 1/10W		
R13			RK73FB2A221J	CHIP R 220 J 1/10W		
R14			R92-0670-05	CHIP R 0.6HM		
R15			RK73FB2A822J	CHIP R 8.2K J 1/10W		
R16			RK73FB2A471J	CHIP R 470 J 1/10W		
R17			RK73FB2A153J	CHIP R 15K J 1/10W		
R18			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R19			RD14BR2C101J	RD 100 J 1/6W		
R101			RK73FB2A392J	CHIP R 3.9K J 1/10W		
R102			RK73FB2A104J	CHIP R 100K J 1/10W		
R103			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R104			RK73FB2A102J	CHIP R 1.0K J 1/10W		
VR5			R23-9403-05	POTENTIOMETER (10K/50K)AF,SO		
W1			R92-1061-05	JUMPER RES 0.6HM		
W4			R92-1061-05	JUMPER RES 0.6HM		
D1			MI303	DIODE		
D2		*	HSK277	CHIP DIODE		
D4		*	DAN202U	CHIP DIODE		
IC1		*	M57796MA	IC(POWER MODULE/ 144-148MHZ)		
Q1			2SB1182(Q)	TRANSISTOR		
Q2			2SC2714(Q)	CHIP TRANSISTOR		
Q3			2SB1182(Q)	TRANSISTOR		
Q4		*	DTC143TU	DIGITAL TRANSISTOR		
Q5		*	DTC114EU	DIGITAL TRANSISTOR		
Q9		*	DTC143TK	DIGITAL TRANSISTOR		B
Q101		*	2SC4116(GR)	CHIP TRANSISTOR		
Z1		*	X59-3320-10	FRONT UNIT		
Z2		*	X58-3210-11	IF UNIT		
Z3		*	X59-3310-10	AF AMP UNIT		
Z4		*	X59-3300-10	MIC AMP UNIT		A
Z4		*	X59-3300-10	MIC AMP UNIT		B
Z4		*	X59-3300-61	MIC AMP UNIT		C
Z5		*	X59-3330-10	DRIVE UNIT		
Z6		*	X58-3220-10	APC UNIT		
Z7		*	X58-3200-10	AVR UNIT		

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Z8		*	X58-3230-10	PLL UNIT		
AVR UNIT (X58-3200-10)						
C1			CK73FB1H471K	CHIP C 470PF K		
C2			CK73FB1H103K	CHIP C 0.010UF K		
C3	.4		CK73FB1H471K	CHIP C 470PF K		
C5			CK73FB1H103K	CHIP C 0.010UF K		
C6			CK73FB1H471K	CHIP C 470PF K		
C8	.9		CK73FB1H471K	CHIP C 470PF K		
C10	.11		C92-0004-05	CHIP TAN 1UF 16WV		
C12			CK73FB1H471K	CHIP C 470PF K		
C13			CK73FB1H102K	CHIP C 1000PF K		
C14			CK73FB1E104K	CHIP C 0.10UF K		
C15			CK73FB1H471K	CHIP C 470PF K		
C16			CK73FB1E104K	CHIP C 0.10UF K		
C17			CK73FB1H471K	CHIP C 470PF K		
C18	-20		CK73FB1H102K	CHIP C 1000PF K		
C21	-23		CK73FB1H471K	CHIP C 470PF K		
C24			C92-0507-05	TANTAL 4.7UF 6.3WV		
C25	.26		CK73FB1H471K	CHIP C 470PF K		
C27			C92-0501-05	CHIP TAN 1.5UF 6.3WV		
		*	E23-0610-05	TERMINAL		
L1	.2	*	L92-0123-05	FERRITE BEAD		
R1			RK73FB2A103J	CHIP R 10K J 1/10W		
R2			RK73FB2A473J	CHIP R 47K J 1/10W		
R3			RK73FB2A272J	CHIP R 2.7K J 1/10W		
R4			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R5			RK73FB2A272J	CHIP R 2.7K J 1/10W		
R6			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R7			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R8			RK73FB2A274F	CHIP R 270K F 1/10W		
R9		*	RK73FB2A124F	CHIP R 120K F 1/10W		
R10			RK73FB2A223J	CHIP R 22K J 1/10W		
R11			R92-0670-05	CHIP R 0 OHM		
R12			RK73FB2A183J	CHIP R 18K J 1/10W		
R13			R92-0679-05	CHIP R 0 OHM		
D1	.2	*	MA110	CHIP DIODE		
IC1		*	LP2950CZ	IC (VOLTAGE REGULATOR/ +5V)		
IC2		*	TMX1	IC		
Q1		*	2SD1819	CHIP TRANSISTOR		
Q2		*	2SA1313(Y)	CHIP TRANSISTOR		
Q3		*	UN5119	DIGITAL TRANSISTOR		
Q4		*	DTC144EU	DIGITAL TRANSISTOR		
Q5		*	2SB1218	CHIP TRANSISTOR		
IF UNIT (X58-3210-11)						
C1			CK73FB1E104K	CHIP C 0.10UF K		
C2			C92-0004-05	CHIP TAN 1UF 16WV		
C3			C92-0005-05	CHIP-TAN 2.2UF 6.3WV		
C4			CK73FB1E223K	CHIP C 0.022UF K		
C5	-8		CK73FB1H102K	CHIP C 1000PF K		
C10			CK73FB1H102K	CHIP C 1000PF K		
C11			C92-0001-05	CHIP TAN 0.1UF 35WV		
C13			C92-0005-05	CHIP-TAN 2.2UF 6.3WV		

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C14 C16 C17 -19 C20 C21			CC73FCH1H330J CC73FCH1H820J CK73ER1F104K CC73FCH1H820J CK73FB1E223K	CHIP C 33PF J CHIP C 82PF J CHIP C 0.10UF K CHIP C 82PF J CHIP C 0.022UF K		
-			E23-0610-05	TERMINAL		
CD1 CF1		* *	L79-0817-05 L72-0362-05	FILIER (CDBM455C7) CERAMIC FILTER (CFUM455E)		
R1 R2 R3 R4 R5			RK73FB2A152J RK73FB2A332J RK73FB2A102J RK73FB2A274J RK73FB2A473J	CHIP R 1.5K J 1/10W CHIP R 3.3K J 1/10W CHIP R 1.0K J 1/10W CHIP R 270K J 1/10W CHIP R 47K J 1/10W		
R6 R7 R8 R9 R10			RK73FB2A152J RK73FB2A332J RK73FB2A472J RK73FB2A561J RK73FB2A473J	CHIP R 1.5K J 1/10W CHIP R 3.3K J 1/10W CHIP R 4.7K J 1/10W CHIP R 560 J 1/10W CHIP R 47K J 1/10W		
R11 R12 R13 R14 R15			RK73FB2A122J RK73FB2A222J R92-0670-05 RK73FB2A681J RK73FB2A101J	CHIP R 1.2K J 1/10W CHIP R 2.2K J 1/10W CHIP R 0.68M CHIP R 680 J 1/10W CHIP R 100 J 1/10W		
TH1 VR1		*	R92-0680-05 R12-4419-05	FIXED RESISTOR (FR5-M33J752U) TRIMMING PST. (68K)		
D1 IC1 Q1		*	H5MB8AS TK10487MT1 (B-C) 2SC2712 (GR)	CHIP DIODE IC CHIP TRANSISTOR		
APC UNIT (X58-3220-10)						
C1 C3 C4 C5	.2 .6		CK73FB1H471K CC73FCH1H151J C92-0005-05 CK73FB1H471K	CHIP C 470PF K CHIP C 150PF J CHIP-TAN 2.2UF 6.3WV CHIP C 470PF K		
-			E23-0610-05	TERMINAL		
R1 R2 R3 R4 R5		*	RK73FB2A103J RK73FB2A223J RK73FB2A683J R92-1203-05 RK73FB2A222J	CHIP R 10K J 1/10W CHIP R 22K J 1/10W CHIP R 68K J 1/10W CHIP R 0.22 J 1/2W CHIP R 2.2K J 1/10W		
R6 R7 R8 R9 VR1			RK73FB2A124J RK73FB2A102J RK73FB2A103J RK73FB2A102J R12-1439-05	CHIP R 120K J 1/10W CHIP R 1.0K J 1/10W CHIP R 10K J 1/10W CHIP R 1.0K J 1/10W TRIMMING PST. (4.7K)		
VR2		*	R12-3461-05	TRIMMING PST. (10K)		
D1 D2 IC1 Q1 Q2			D2C73.9YZ 1SS268 LM301AD 2SA1162 (Y) DTC114YK	CHIP ZENER DIODE CHIP DIODE IC (OP AMP) CHIP TRANSISTOR DIGITAL TRANSISTOR		
TH1		*	159-101-83052	THERMISTOR (100)		

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PLL UNIT (X58-3230-10)						
C1			CC73FCH1H180J	CHIP C 18PF J		
C2			CC73FCH1H100D	CHIP C 10PF D		
C3			CK73FB1H102K	CHIP C 1000PF K		
C4 .5			CC73FCH1H100D	CHIP C 10PF D		
C6 .7			CK73FB1H102K	CHIP C 1000PF K		
C8			CC73FCH1H070D	CHIP C 7.0PF D		
C9			CC73FCH1H100J	CHIP C 10PF J		
C10 .11			CC73FCH1H070D	CHIP C 7.0PF D		
C12			CC73FCH1H180J	CHIP C 18PF J		
C13			CC73FCH1H270J	CHIP C 27PF J		
C14			CC73FCH1H010C	CHIP C 1.0PF C		
C15			CK73FB1H102K	CHIP C 1000PF K		
C16			C92-0003-05	CHIP TAN 0.47UF 25WV		
C17			CK73CB1C104K	CHIP C 0.10UF K		
C18			CK73FB1E103K	CHIP C 0.010UF K		
C19			C92-0003-05	CHIP TAN 0.47UF 25WV		
C20			CC73FCH1H100D	CHIP C 10PF D		
C51 .54			CK73FB1H102K	CHIP C 1000PF K		
C55			CC73FCH1H150J	CHIP C 15PF J		
C56			CC73FCH1H560J	CHIP C 56PF J		
C57			CK73FB1H223K	CHIP C 0.022UF K		
C58			CC73FCH1H101J	CHIP C 100PF J		
C59			CK73FB1E103K	CHIP C 0.010UF K		
C60			CK73FB1H471K	CHIP C 470PF K		
C61			CK73FB1E103K	CHIP C 0.010UF K		
C62			C92-0004-05	CHIP TAN 1UF 16WV		
C63			CK73FB1H182K	CHIP C 1800PF K		
TC1 .2			C05-0346-05	TRIMMING CAP (6PF)		
TC51			C05-0345-05	TRIMMING CAP (10PF)		
CN1			E40-5130-05	PIN CONNECTOR		
CN51			E40-5129-05	PIN CONNECTOR		
-			F10-1367-04	SHIELDING PLATE		
-		*	F11-1075-03	SHIELDING COVER		
-			F20-0591-04	INSULATING BOARD		
L1		*	L34-2305-05	COIL		
L2		*	L34-4084-05	COIL		
X51			L77-1358-05	CRYSTAL RESONATOR (12.8MHZ)		
R1			RK73FB2A471J	CHIP R 47U J 1/10W		
R2			RK73FB2A104J	CHIP R 100K J 1/10W		
R3			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R4			RK73FB2A104J	CHIP R 100K J 1/10W		
R5			RK73FB2A473J	CHIP R 47K J 1/10W		
R6 .7			RK73FB2A104J	CHIP R 100K J 1/10W		
R8 .9			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R10			RK73FB2A184J	CHIP R 180K J 1/10W		
R11			RK73FB2A104J	CHIP R 100K J 1/10W		
R12 .13			RK73FB2A332J	CHIP R 3.3K J 1/10W		
R14 .15			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R16			RK73FB2A183J	CHIP R 18K J 1/10W		
R17			RK73FB2A103J	CHIP R 10K J 1/10W		
R51			RK73FB2A223J	CHIP R 22K J 1/10W		
R53			RK73FB2A102J	CHIP R 1.0K J 1/10W		

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R54 ,55 R56 ,57 R58			RK73FB2A104J RK73FB2A272J RK73FB2A822J	CHIP R 100K J 1/10W CHIP R 2.7K J 1/10W CHIP R 8.2K J 1/10W		
D1 ,2 D3 IC51 Q1 ,2 Q3		*	MA344B MA862 M54959FP 2SC2714(Y) FM64	CHIP DIODE CHIP DIODE IC(FREQ SYNTHESIZER PLL) CHIP TRANSISTOR DIGITAL TRANSISTOR		
Q4 Q51 Q52		*	IMX5 2SC2714(Y) XN6501	DIGITAL TRANSISTOR CHIP TRANSISTOR DIGITAL TRANSISTOR		
MIC AMP UNIT (X59-3300-XX) -10:TH-25A TH-25AT -61:TH-25E						
C1 ,2 C3 C4 C5 C6			CK73FB1E473M CK73FB1E223K CK73FB1H471K C92-0002-05 C92-0005-05	CHIP C 0.047UF M CHIP C 0.022UF K CHIP C 470PF K CHIP TAN 0.22UF 35WV CHIP-TAN 2.2UF 6.3WV		
C7 C8 C9 C10 C11			CK73FB1H102K CK73FSL1H151J CK73FB1H182K C92-0507-05 CK73FB1H103K	CHIP C 1000PF K CHIP C 150PF J CHIP C 1800PF K TANTAL 4.7UF 6.3WV CHIP C 0.010UF K		
C13 C14 C15			CK73FB1H471K C92-0507-05 CK73FB1H103K	CHIP C 470PF K TANTAL 4.7UF 6.3WV CHIP C 0.010UF K		
-			E23-0610-05	TERMINAL		
R1 R2 R3 R4 R5			RK73FB2A183J RK73FB2A684J RK73FB2A103J RK73FB2A272J R92-0677-05	CHIP R 18K J 1/10W CHIP R 680K J 1/10W CHIP R 10K J 1/10W CHIP R 2.7K J 1/10W CHIP R 0 OHM		
R6 R7 R8 R8 R8			RK73FB2A103J RK73FB2A472J RK73FB2A154J RK73FB2A823J RK73FB2A823J	CHIP R 10K J 1/10W CHIP R 4.7K J 1/10W CHIP R 150K J 1/10W CHIP R 82K J 1/10W CHIP R 82K J 1/10W		
R9 R10 R11 R12 R13			RK73FB2A104J RK73FB2A391J RK73FB2A472J RK73FB2A223J RK73FB2A273J	CHIP R 100K J 1/10W CHIP R 390 J 1/10W CHIP R 4.7K J 1/10W CHIP R 22K J 1/10W CHIP R 27K J 1/10W		
R14 R15 R16 R17 R18			RK73FB2A104J RK73FB2A472J RK73FB2A562J RK73FB2A563J RK73FB2A332J	CHIP R 100K J 1/10W CHIP R 4.7K J 1/10W CHIP R 5.6K J 1/10W CHIP R 56K J 1/10W CHIP R 3.3K J 1/10W		
R19 R20 R21 VR1			RK73FB2A222J R92-0679-05 R92-0670-05 R12-6407-05	CHIP R 2.2K J 1/10W CHIP R 0 OHM CHIP R 0 OHM TRIMMING PNT. (470K)		
IC1 TH1		*	NJM4560M 159-252-83003	IC(OP AMP X2) THERMISTER (2.5K)		

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AF AMP UNIT (X59-3310-10)						
C1			CK73FB1H102K	CHIP C 1000PF	K	
C2			CK73FB1H103K	CHIP C 0.010UF	K	
C3			CK73FB1E473M	CHIP C 0.047UF	M	
C4			C92-0501-05	CHIP TAN 1.5UF	6.3WV	
C5			CK73FB1H102K	CHIP C 1000PF	K	
C6			CK73FB1E473M	CHIP C 0.047UF	M	
C7			CK73FB1H103K	CHIP C 0.010UF	K	
C8			C92-0004-05	CHIP TAN 1UF	16WV	
-			E23-0610-05	TERMINAL		
R1			RK73FB2A222J	CHIP R 2.2K	J 1/10W	
R2			RK73FB2A473J	CHIP R 47K	J 1/10W	
R3			RK73FB2A273J	CHIP R 27K	J 1/10W	
R4			RK73FB2A331J	CHIP R 330	J 1/10W	
R5			RK73FB2A100J	CHIP R 10	J 1/10W	
R6			RK73FB2A103J	CHIP R 10K	J 1/10W	
D1			02CZ6.8X	CHIP ZENER DIODE		
IC1			NJM386BM	IC(OP AMP)		
Q1		*	25B1182(F5)Q	CHIP TRANSISTOR		
Q2			25C2712(GR)	CHIP TRANSISTOR		
Q3			DTC144EK	DIGITAL TRANSISTOR		
FRONT-END UNIT (X59-3320-10)						
C1			CK73FB1H102K	CHIP C 1000PF	K	
C2			CK73FB1H101J	CHIP C 100PF	J	
C3 -5			CK73FB1H102K	CHIP C 1000PF	K	
C6			CC73FCH1H090D	CHIP C 9.0PF	D	
C7			CC73FCH1H020C	CHIP C 2.0PF	C	
C8			CC73FCH1HR50C	CHIP C 0.50PF	C	
C9			CC73FCH1H090D	CHIP C 9.0PF	D	
C10			CC73FCH1H030C	CHIP C 3.0PF	C	
C11			CC73FCH1HR50C	CHIP C 0.50PF	C	
C12			CC73FCH1H090D	CHIP C 9.0PF	D	
C13			CC73FCH1H020C	CHIP C 2.0PF	C	
C14			CK73FB1E103K	CHIP C 0.010UF	K	
C15			CK73FB1H102K	CHIP C 1000PF	K	
C16			CK73FB1E223K	CHIP C 0.022UF	K	
C17			CC73FFH1H390J	CHIP C 39PF	J	
C18			CC73FCH1H030C	CHIP C 3.0PF	C	
L17			CC73FCH1H100D	CHIP C 10PF	D	
C20 +21			CK73FB1H102K	CHIP C 1000PF	K	
-			E23-0610-05	TERMINAL		
L1		*	L34-2307-15	COIL		
L2 -4		*	L34-4052-05	COIL		
L5			L40-4772-80	SMALL FIXED INDUCTOR (47NH)		
R1 +2			RK73FB2A103J	CHIP R 10K	J 1/10W	
R3			RK73FB2A221J	CHIP R 220	J 1/10W	
R4			RK73FB2A103J	CHIP R 10K	J 1/10W	
R5			RK73FB2A470J	CHIP R 47	J 1/10W	
R6			RK73FB2A101J	CHIP R 100	J 1/10W	
R7			RK73FB2A561J	CHIP R 560	J 1/10W	
R8			RK73FB2A470J	CHIP R 47	J 1/10W	

E: Scandinavia & Europe K: USA

P: Canada

U: PX(Far East, Hawaii)

T: England

M: Other Areas

UE: AAFES(Europe)

X: Australia

A : TH-25A

B : TH-25AT

C : TH-25E

△ indicates safety critical components.

PARTS LIST

* New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés dans le Parts No. ne sont pas fournis.

Teile ohne Parts No. werden nicht geliefert.

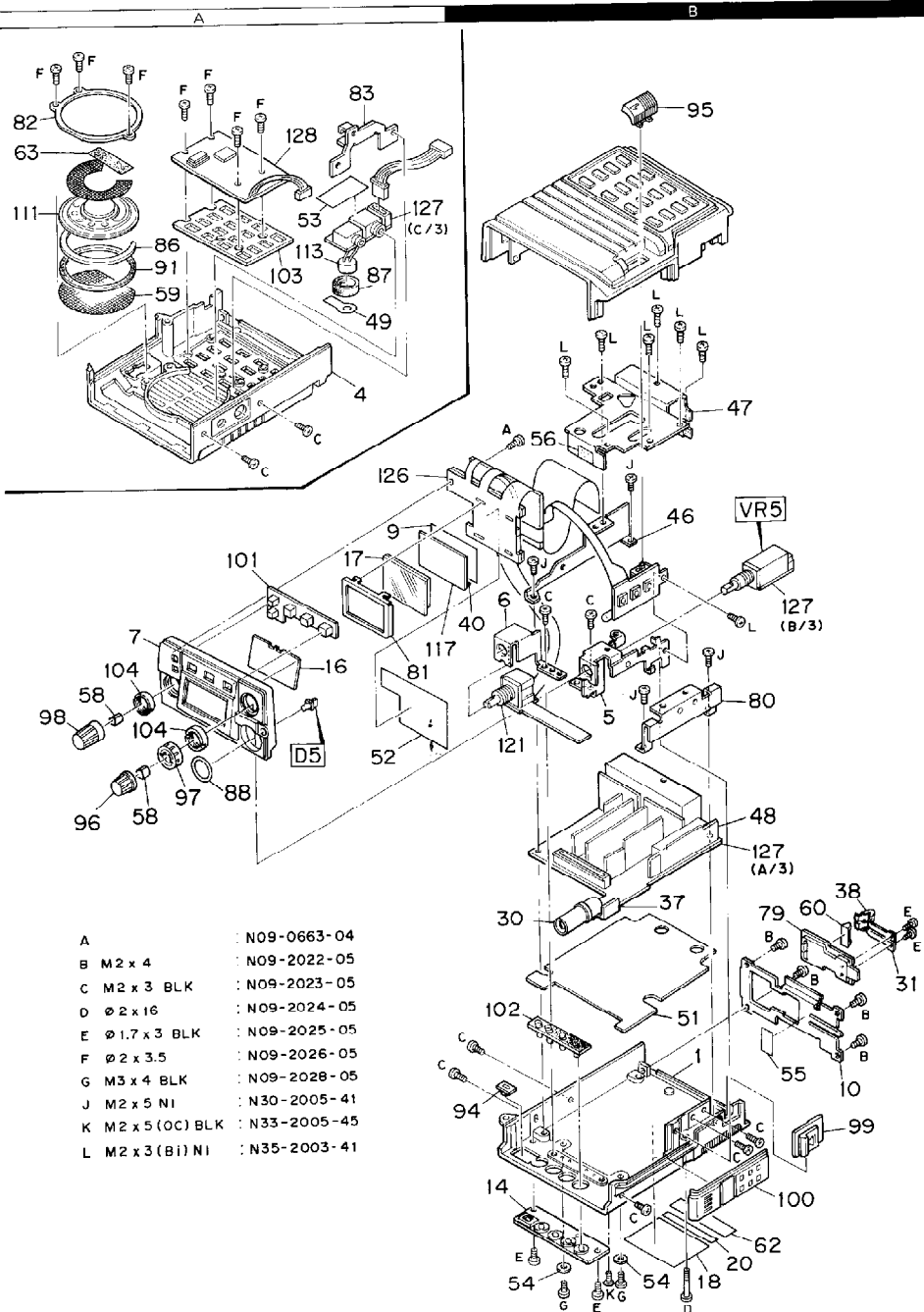
Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕向	Re- marks 備考
R9			RK73FB2A103J	CHIP R 10K J 1/10W		
R10			RK73FB2A470J	CHIP R 47 J 1/10W		
R11		*	R90-0702-05	MULTI-COMP (100KX4)		
R12			RK73FB2A222J	CHIP R 2.2K J 1/10W		
D1			HSM88AS	CHIP DIODE		
D2		*	DAP202U	CHIP DIODE		
D3		*	MA344B	CHIP DIODE		
Q1		*	2SC3937	CHIP TRANSISTOR		
Q2		*	2SC4215(Y)	CHIP TRANSISTOR		
Q3		*	2SK302(Y)	CHIP FET		
DRIVE UNIT (X59-3330-10)						
C1 -3			CK73FB1H102K	CHIP C 1000PF K		
C4			CC73FCH1H150J	CHIP C 15PF J		
C5 -7			CK73FB1H102K	CHIP C 1000PF K		
C8			CC73FCH1H120J	CHIP C 12PF J		
-			E23-0610-05	TERMINAL		
L1 ,2			L40-6872-B0	SMALL FIXED INDUCTOR (68NH)		
R1			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R2			RK73FB2A103J	CHIP R 10K J 1/10W		
R3			RK73FB2A101J	CHIP R 100 J 1/10W		
R4			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R5			RK73FB2A560J	CHIP R 56 J 1/10W		
R6			RK73FB2A152J	CHIP R 1.5K J 1/10W		
R7			RK73FB2A470J	CHIP R 47 J 1/10W		
R8			RK73FB2A150J	CHIP R 15 J 1/10W		
R9			RK73FB2A120J	CHIP R 12 J 1/10W		
R10			R92-0670-05	CHIP R 0 OHM		
D1			1SS268	CHIP DIODE		
D2			1SS226	CHIP DIODE		
U1			2SC2714(Y)	CHIP TRANSISTOR		
Q2			2SC2954	CHIP TRANSISTOR		

E: Scandinavia & Europe K: USA P: Canada
 U: PX(Far East: Hawaii) T: England M: Other Areas
 UE: AAFES(Europe) X: Australia

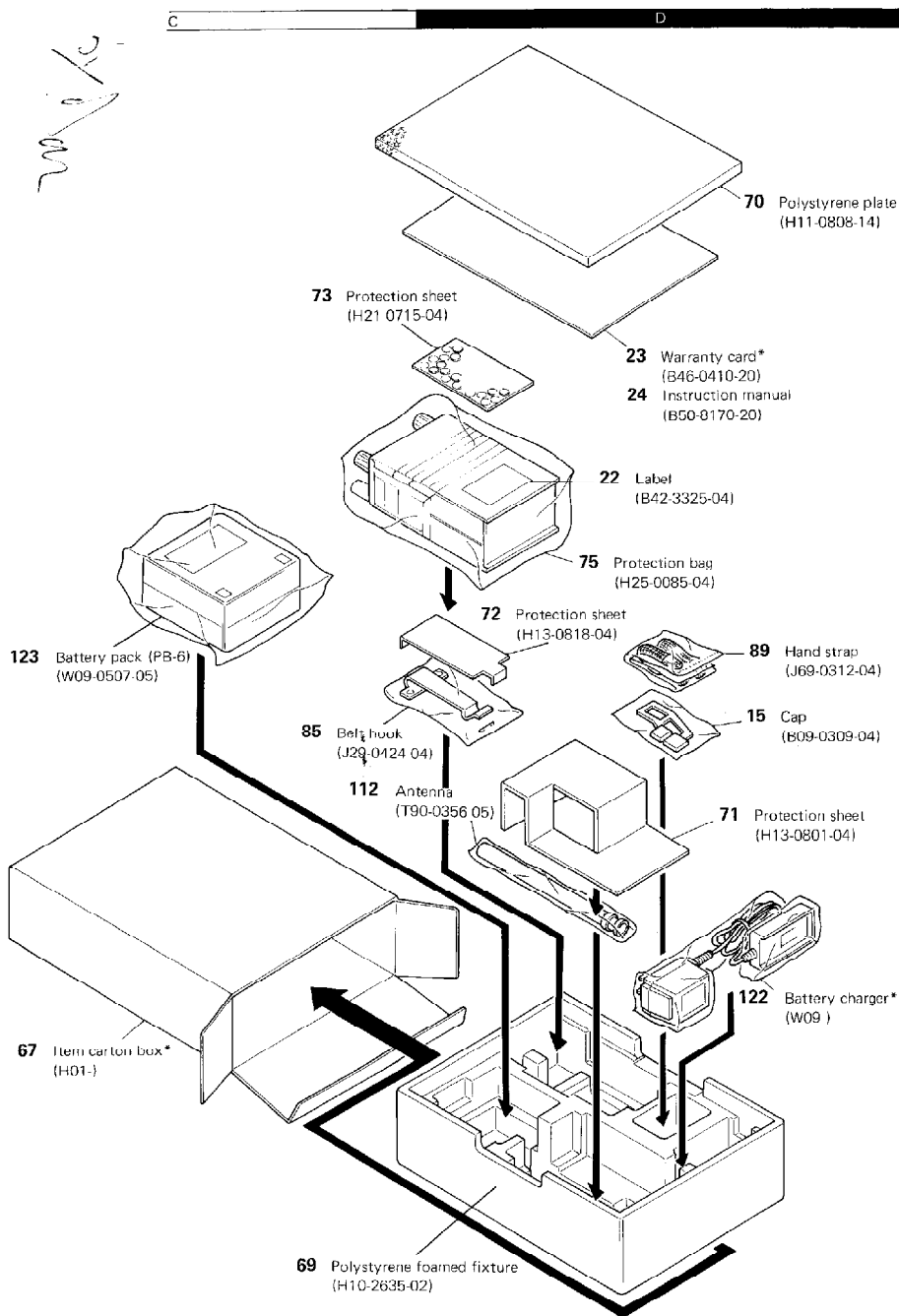
A : TH-25A
 B : TH-25AT
 C : TH-25E

⚠ Indicates safety critical components.

DISASSEMBLY



PACKING



* Refer to parts list on page 15.

ADJUSTMENT

REQUIRED TEST EQUIPMENT

1. Stabilized Power Supply

- 1) The supply voltage can be changed between 5V and 18V, and the current is 3A or more.
- 2) The standard voltage is 12.0V.

2. DC Ammeter

- 1) Class 1 ammeter (17 ranges and other features)
- 2) The full scale can be set to either 300mA or 3A.
- 3) A cable of less internal loss must be used.

3. Frequency Counter (f. counter)

- 1) Frequencies of up to 1GHz or so can be measured.
- 2) The sensitivity can be changed to 250MHz or below, and measurements are highly stable and accurate (0.2 ppm or so).

4. Power Meter

- 1) Measurable frequency : Up to 500MHz
- 2) Impedance : 50Ω, unbalanced
- 3) Measuring range : Full scal of 10W or so
- 4) A standard cable (5D2W 1m) must be used.

5. RF VTVM (RF V.M)

- 1) Measurable frequency : Up to 500MHz or so

6. Linear Detector

- 1) Measurable frequency : Up to 500MHz
- 2) Characteristics are flat, and CN is 60dB or more.

7. Digital Voltmeter

- 1) Voltage range : FS = 18V or so
- 2) Input resistance : 1MΩ or more

8. Oscilloscope

- 1) Measuring range : DC to 30MHz
- 2) Provides highly accurate measurments for 5 to 25 MHz.

9. AF Voltmeter (AF VTVM)

- 1) Measurable frequency : 50Hz to 1MHz
- 2) Maximum sensitivity : 1mV or more

10. Spectrum Analyzer

- 1) Measuring range : DC to 1GHz or more

11. Standard Signal Generator (SSG)

- 1) Maximum frequency : 500MHz or more
- 2) Output : -20dB/0.1μV to 120dB/1V
- 3) Output impedance : 50Ω

12. Tracking Generator

- 1) Center frequency : 50kHz to 500MHz
- 2) Frequency deviation : ±35MHz
- 3) Output voltage : 100mV or more

13. Dummy Load

- 1) 8Ω, 3W or more

PREPARATION


- Set the unit in the receiving mode and set the controls as follows, unless otherwise specified.

POWER/VOL ON
 SQL VR MIN
 F.LOCK OFF
 HI/LOW HI

- Use a non-conductive rod such as a Bakelite rod for adjustment (especially of trimmers and coils).
- To protect the SSG, do not send out signals while adjusting the receiving unit.
- The indicated SSG output levels are for maximum output.

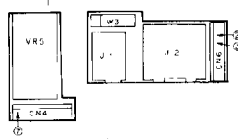
ADJUSTMENT

RESET

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. Reset	1) POWER SW : OFF 2) Hold down  key POWER SW : ON						Unit reset.	Display 144.000

TX-RX COMMON ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. Voltage check	1) Power supply voltage : 12V (External)	DC V.M	TX-RX (B/3)	CN4-7			Check	12V
	2) 5M		TX-RX (C/3)	CN6-3				5V
	3) 5T PTT : ON			CN6-2				5V

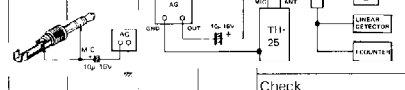


PLL ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. Reference frequency	1) FREQ. : 146.000MHz K,M,M2,M3,M4,X FREQ. : 144.950MHz T,W PTT : ON	f. counter Power meter		ANT	PLL	TC51	146.000MHz K,M,M2,M3,M4,X 144.950MHz T,W	±100Hz
2. VCV	1) FREQ. : 145.990MHz	DC V.M	TX-RX (A/3)	TP1	PLL	L1	2.4V	±0.2V
	2) FREQ. : 145.990MHz PTT : ON	Power meter				L2	2.4V	±0.2V

TX ADJUSTMENT

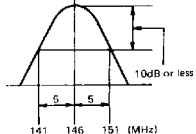
Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. Power adjustment (Repeat 2 ~ 3 times.)	1) FREQ. : 147.995MHz K,M,M2,M3,M4,X FREQ. : 145.975MHz T,W HI/LOW : HI PTT : ON	Power meter Ammeter		ANT	APC	VR1	MAX.	5.5W or more.
	2) HI/LOW : LOW						500mW	±50mW Power consumption : 500mA or less.
	3) HI/LOW : HI					VR2	5.3W	Power consumption : 1.2A or less.
2. DEV	1) FREQ. : 146.000MHz K,M,M2,M3,M4,X FREQ. : 144.950MHz T,W AG : 1kHz, 80mV K,M,M2,M3,M4,X AG : 1kHz, 40mV T,W PTT : ON	Power meter AG Linear detector f. counter		ANT	MIC AMP	VR3	±4.2kHz	±200Hz
	2) AG : 1kHz, 8mV K,M,M2,M3,M4,X AG : 1kHz, 4mV T,W PTT : ON						Check	DEV : ±3kHz ± 700Hz



ADJUSTMENT

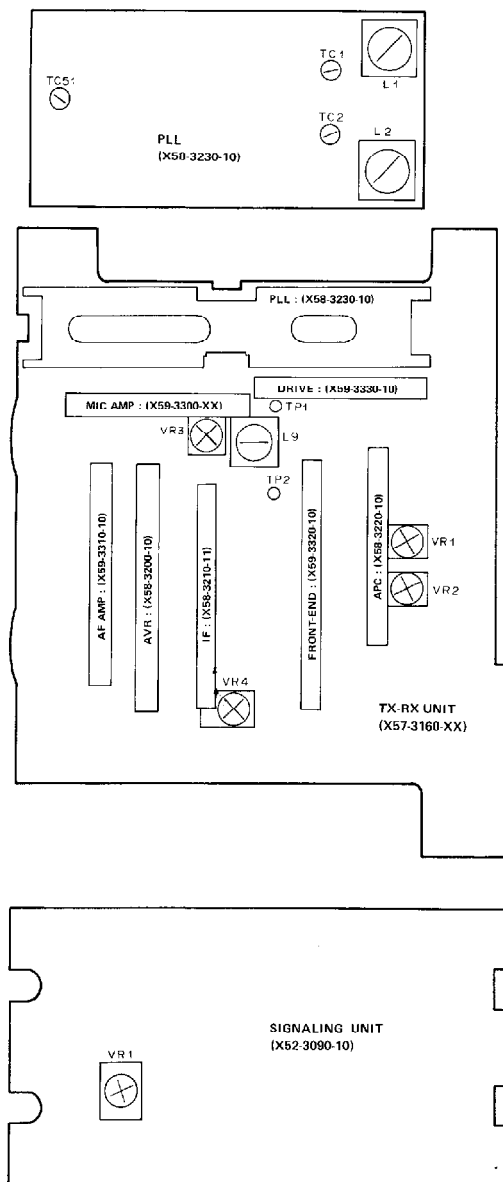
Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
3. TONE TH-25E only	1) FREQ. : 144.950MHz TONE : ON T TONE : Push W	Power meter Linear detector Oscilloscope		ANT			Check	$\pm 2.5 \sim \pm 4.5\text{kHz}$
4. DTMF TH-25AT only	1) FREQ. : 146.000MHz PTT : ON Key board : A , B push	Power meter Linear detector f. counter		ANT	Signal-ing	VR1	DEV : $\pm 3\text{kHz}$	$\pm 200\text{Hz}$
	2) Keyboard : 2 , 3 push	Oscilloscope					Check	FREQ. : 1639Hz $\pm 20\text{Hz}$, -10Hz DEV : $\pm 0.7\text{kHz} \sim \pm 1.7\text{kHz}$

RX ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. Reception sensitivity	1) Tracking generator output : -40dBm	T.G.		ANT			Check	
		Spectrum analyzer	TX-RX	TP2				
	2) FREQ. : 146.040MHz K, M, M2, M3, M4, X FREQ. : 145.050MHz T, W SSG output : $500\mu\text{V} \sim 47\text{dBm}$ MOD : 1kHz DEV : 3kHz	Oscilloscope AF V.M Distortion meter SSG		EXT.SP	TX-RX (A/3)	L9	Adjust L9 to the minimum distortion.	5% or less.
	3) AF VR : MAX						Check	1.6V or more
	4) SSG output : $0.18\mu\text{V} \sim 116\text{dBm}$						Check	12dB SINAD or more
2. S-meter	5) FREQ. : 144.040MHz K, M, M2, M3, M4, X FREQ. : 144.050MHz T, W							
	1) FREQ. : 146.040MHz K, M, M2, M3, M4, X FREQ. : 145.050MHz T, W SSG output : $3.95\mu\text{V} \sim 89\text{dBm}$	S-meter			IF	VR4	Adjust VR4 that the 6th segment is turned off.	" — — " is one pair.
	2) SSG output : $5\mu\text{V} \sim 87\text{dBm}$						Check	All segment light on.
	3) SSG output : $0.08\mu\text{V} \sim 123\text{dBm}$							All segment light off.

ADJUSTMENT

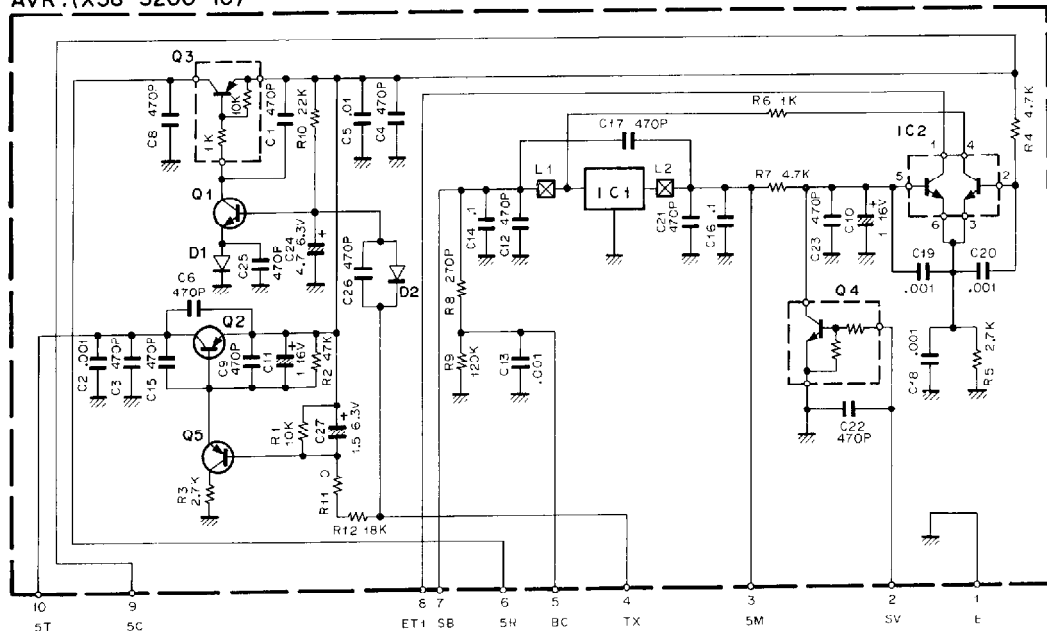
Adjusting point



TH-25A/AT/E PC BOARD VIEWS/CIRCUIT DIAGRAM

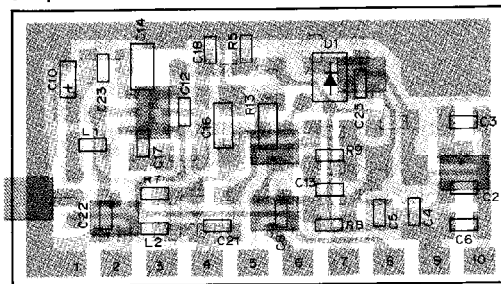
AVR UNIT (X58-3200-10)

AVR : (X58-3200-10)

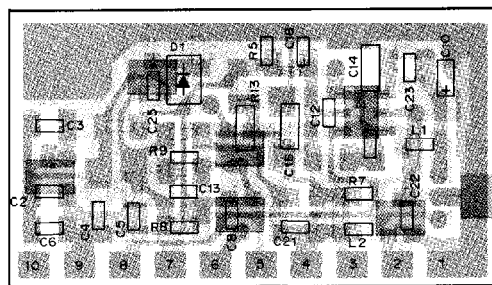


Q1 : 2SD1819 IC1 : LP2950CZ D1,2 : MA110
 Q2 : 2SA1313(Y) IC2 : IMX1
 Q3 : DTA113ZU or UN5119
 Q4 : DTC144EU
 Q5 : 2SB1218

Component side view



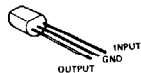
Foil side view



2SA1313(Y)
 2SB1218
 2SC2712(GR)
 2SD1819
 DTC144EU
 UN5119



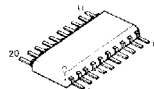
LP2950CZ



IMX1



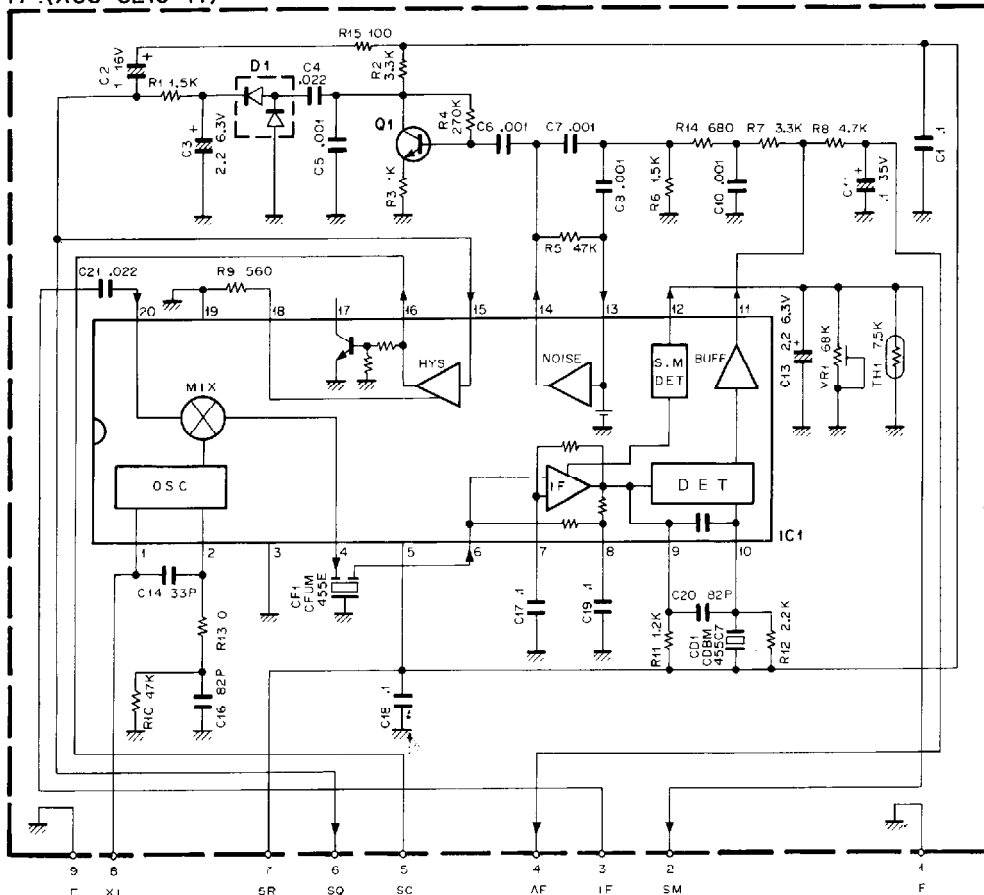
TK10487MT1(B,C)



PC BOARD VIEWS/CIRCUIT DIAGRAM TH-25A/AT/E

IF UNIT (X58-3210-11)

IF:(X58-3210-11)

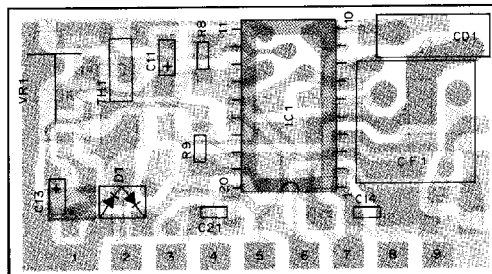


Q1: 2SC2712(GR)

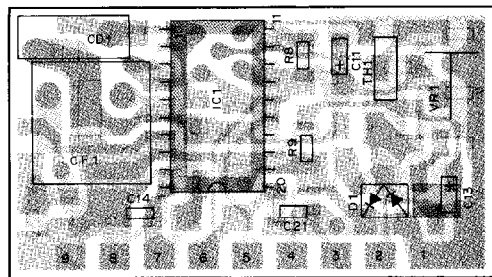
D1: H5M88A5

IC1: TK10487MT1(B,C)

Component side view



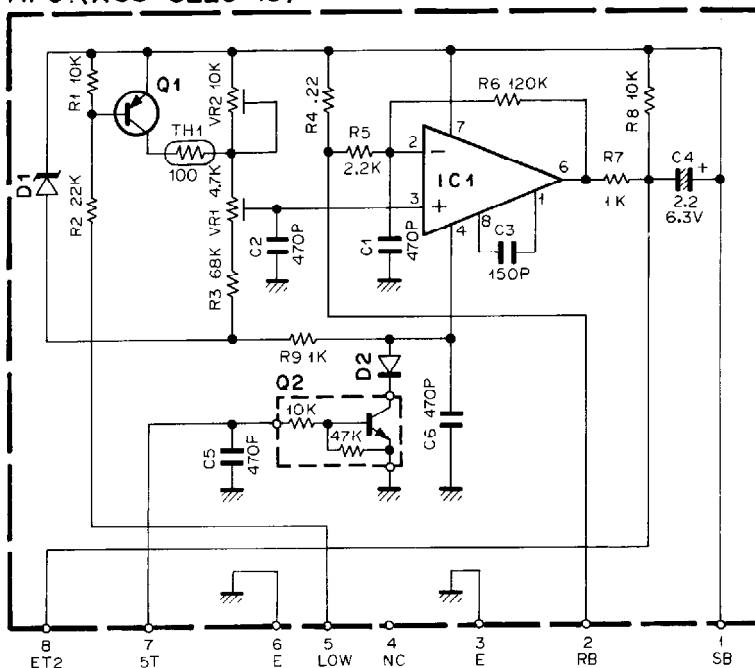
Foil side view



TH-25A/AT/E PC BOARD VIEWS/CIRCUIT DIAGRAM

APC UNIT (X58-3220-10)

APC : (X58-3220-10)



Q1 : 2SA1162(Y)

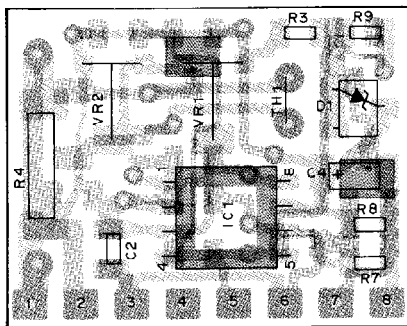
D1 : OC2Z3.9Y,Z

IC1 : LM301AD

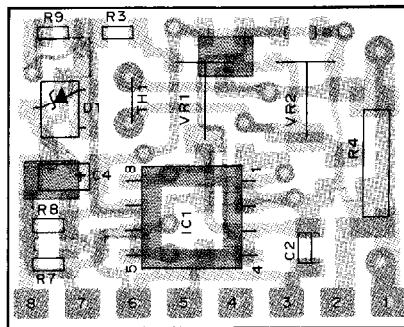
Q2 : DTC114YK

D2 : 1SS268

Component side view



Foil side view



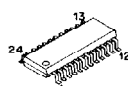
2SA1162(Y)
2SC2714(Y)
DTC114YK



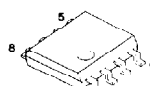
FMG4
IMX5



M54959FP



LM301AD



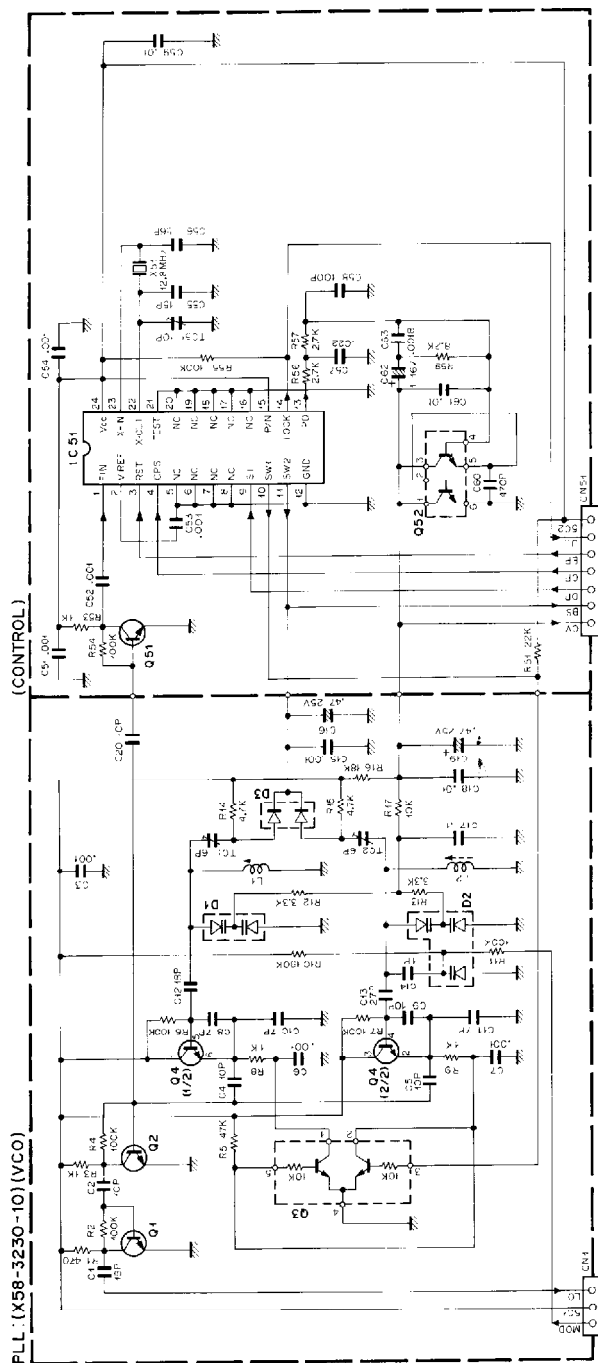
XN6501



PC BOARD VIEWS/CIRCUIT DIAGRAM

TH-25A/AT/E

PLL UNIT (X58-3230-10)

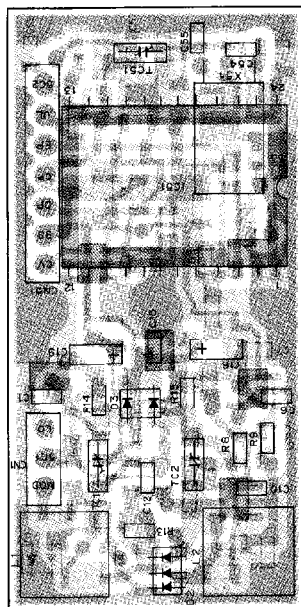


Q1,2,5: 2SC2714(Y)
 Q3: FMG4
 Q4: 1MX5
 Q52: XN6501

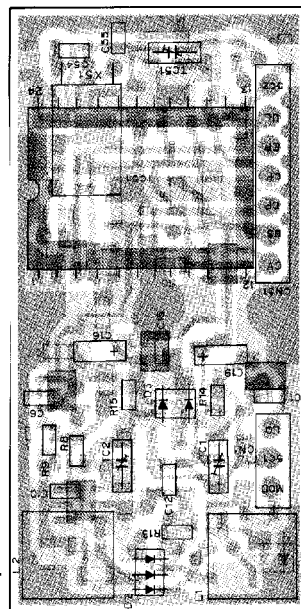
IC51: M54959FP
 D1,2: MA344B
 D3: MA862

Component side
 Foil side

Foil side view



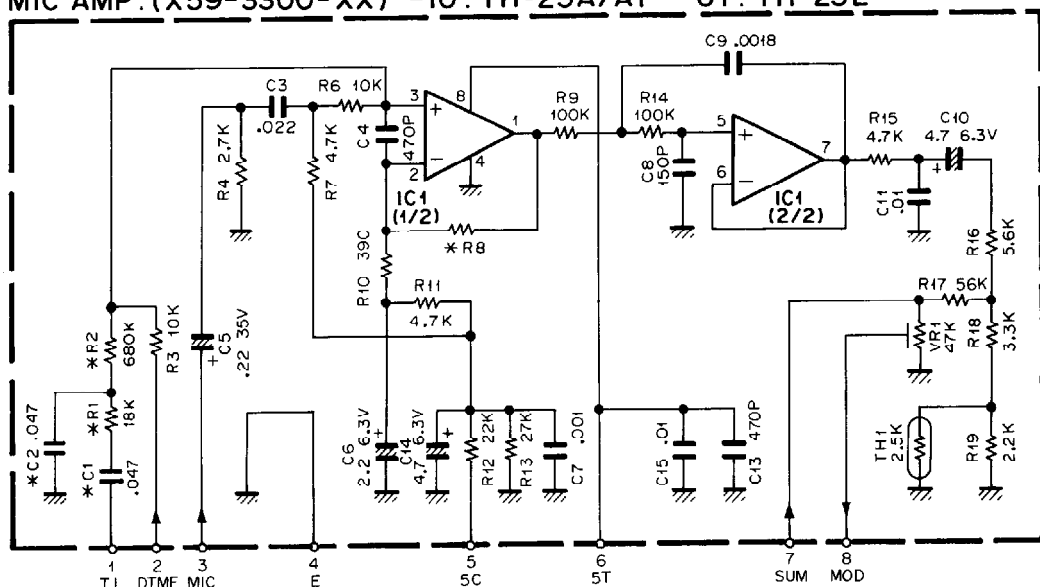
Component side view



TH-25A/AT/E PC BOARD VIEWS/CIRCUIT DIAGRAM

MIC AMP UNIT (X59-3300-XX) -10 : TH-25A/AT -61 : TH-25E

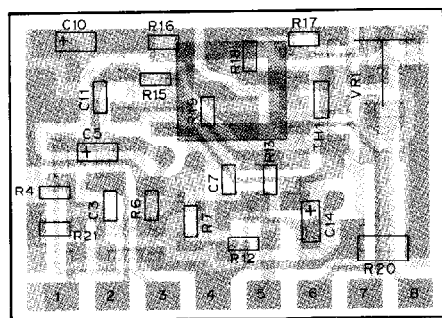
MIC AMP : (X59-3300-XX) -10 : TH-25A/AT -61 : TH-25E



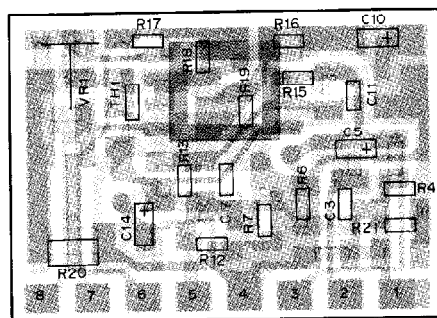
IC1 : NJM4560

	C1,2	R1,2	R8
-10	X	X	82K
-61	O	O	150K

Component side view



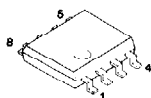
Foil side view



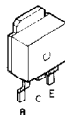
2SC2712(GR)
DTC144EK



NJM386BM
NJM4560



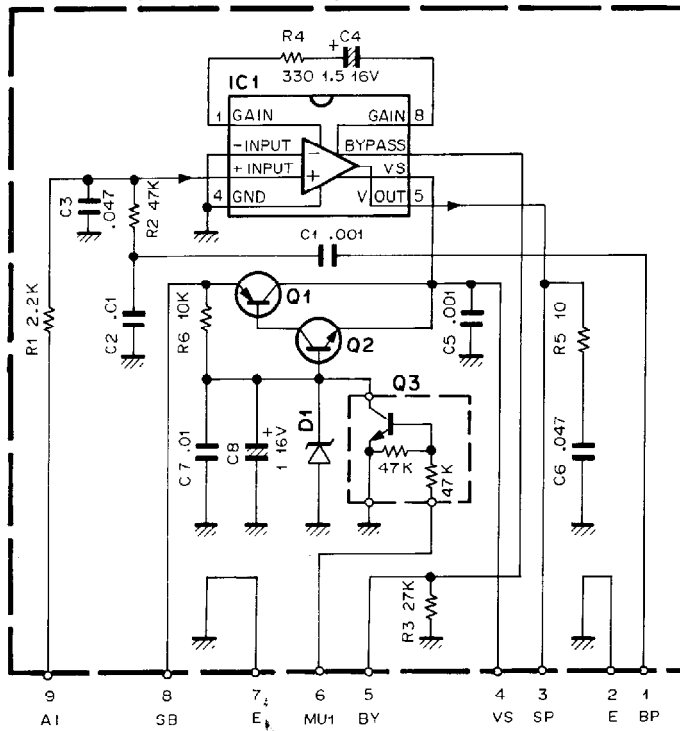
2SB1182(F5)Q



PC BOARD VIEWS/CIRCUIT DIAGRAM TH-25A/AT/E

AF AMP UNIT (X59-3310-10)

AF AMP : (X59-3310-10)



Q1 : 2SB1182(F5)Q

IC1 : NJM386BM

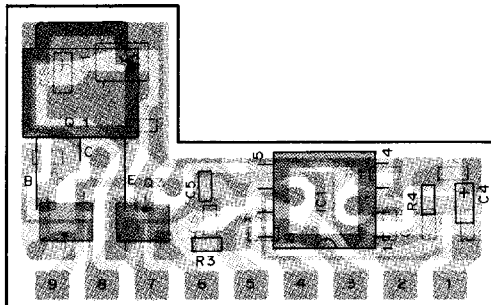
Q2 : 2SC2712(GR)

D1 : O2CZ6.8X or

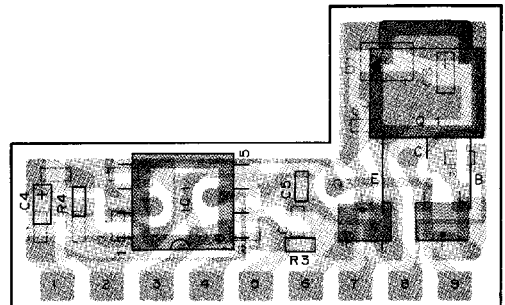
Q3 : DTC144EK

RD6.8M - B1

Component side view



Foil side view



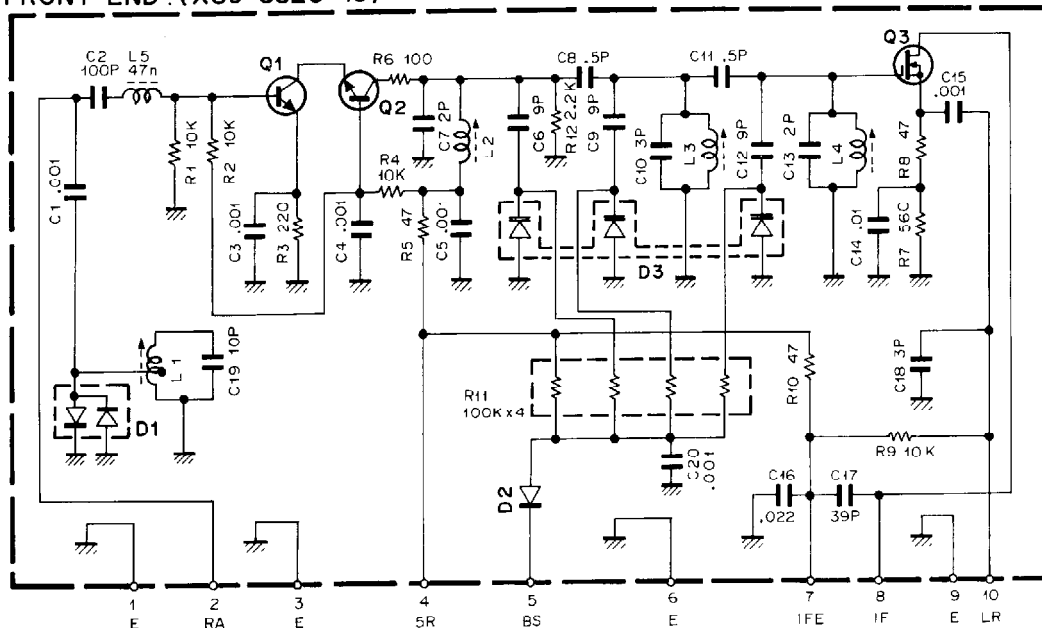
: Component side

: Foil side

TH-25A/AT/E PC BOARD VIEWS/CIRCUIT DIAGRAM

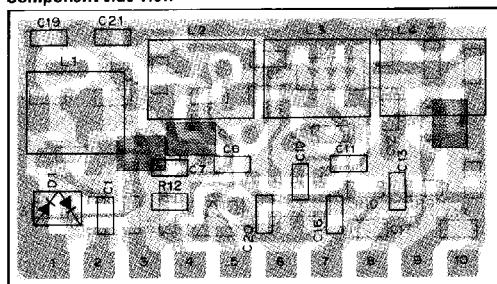
FRONT-END UNIT (X59-3320-10)

FRONT-END : (X59-3320-10)

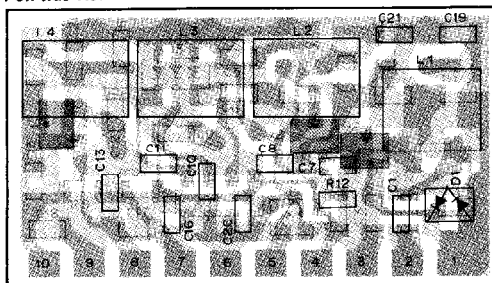


Q1 : 2SC3937
Q2 : 2SC4215(Y)
Q3 : 2SK302(Y)
D1 : HSM88AS
D2 : DAP202U
D3 : MA344B

Component side view



Foil side view



2SC2714(Y)
2SC3937
2SC4215(Y)



2SC2954



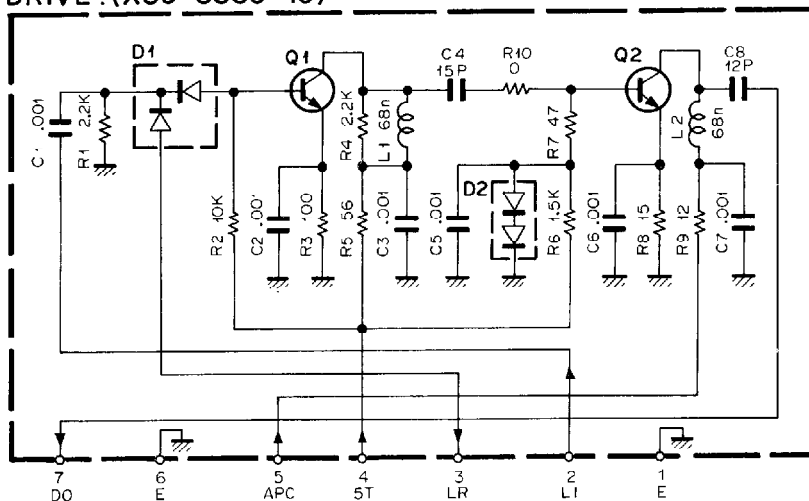
2SK302(Y)



PC BOARD VIEWS/CIRCUIT DIAGRAM TH-25A/AT/E

DRIVE UNIT (X59-3330-10)

DRIVE : (X59-3330-10)

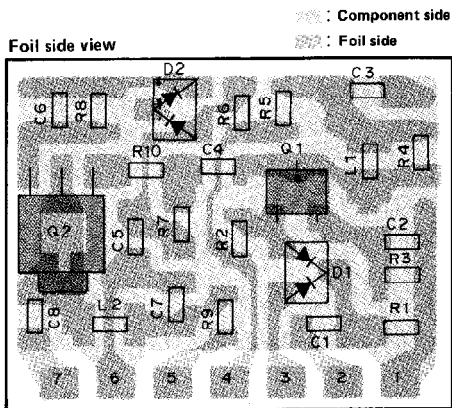


Q1 : 2SC2714(Y)

D1 : 1SS268

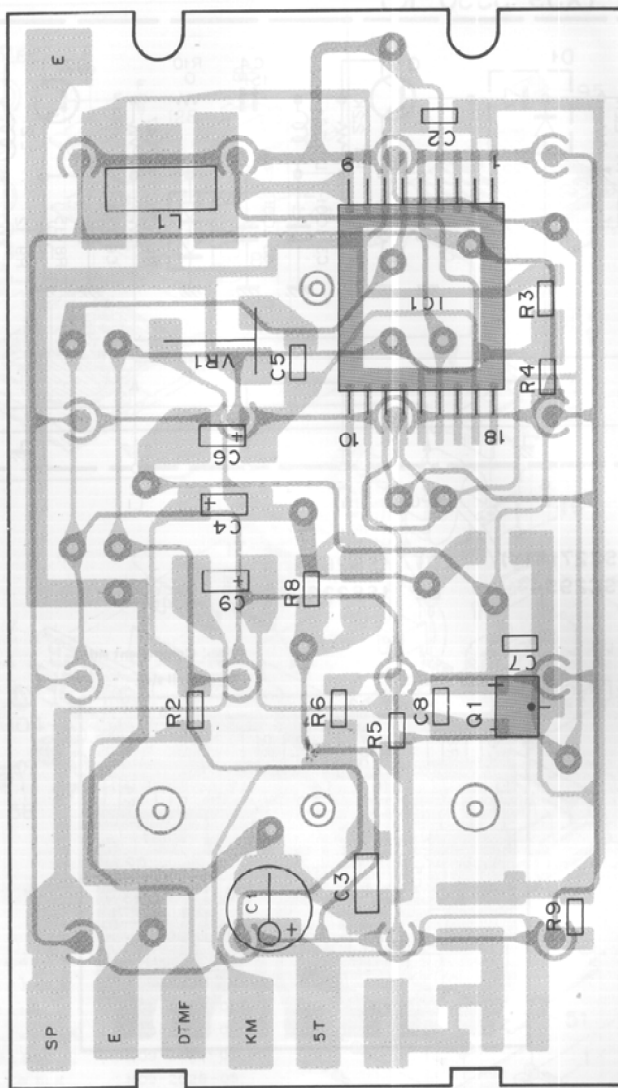
Q2 : 2SC2954

D2 : 1SS226



TH-25A/AT/E PC BOARD VIEWS/CIRCUIT DIAGRAM

SIGNALING UNIT (X52-3090-10) : TH-25AT Component side view



IC1 : LR40872 Q1 : 2SC2712(GF)

■ : Component side
□ : Foil side

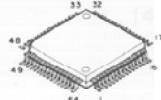
2SA1162(Y)
2SC2712(IGR)
2SC2712(V)



LH5008TP



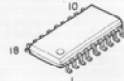
75108AG-018-22



S8054ALR-LN



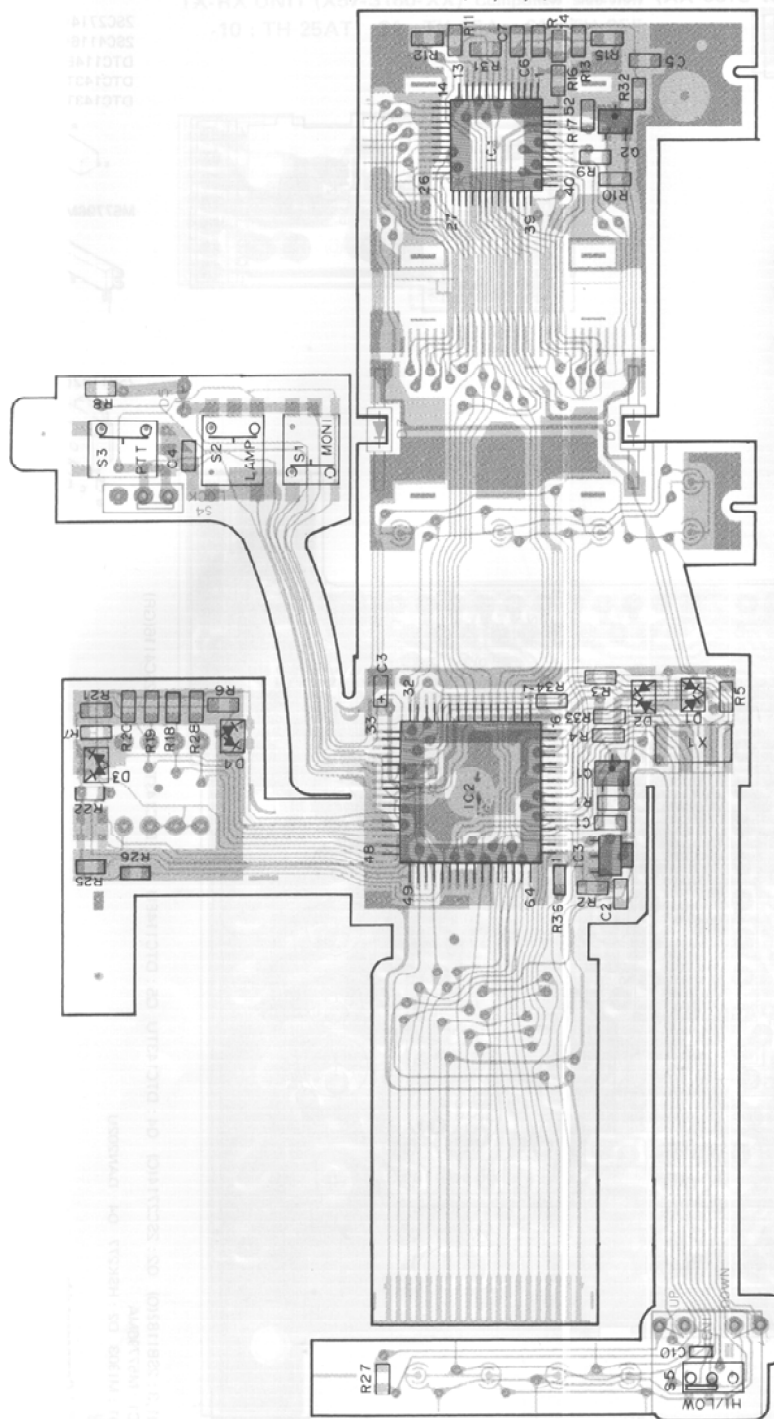
LR40872



CONTROL UNIT (X53-3080-XX)

-11 : TH25AT(K) -12 : TH-25AT(M,M2) TH-25A(M,M2)

-23 : TH-25A(M3,M4,X) -52 : TH-25E(T) -62 : TH-25E(W) Component side view

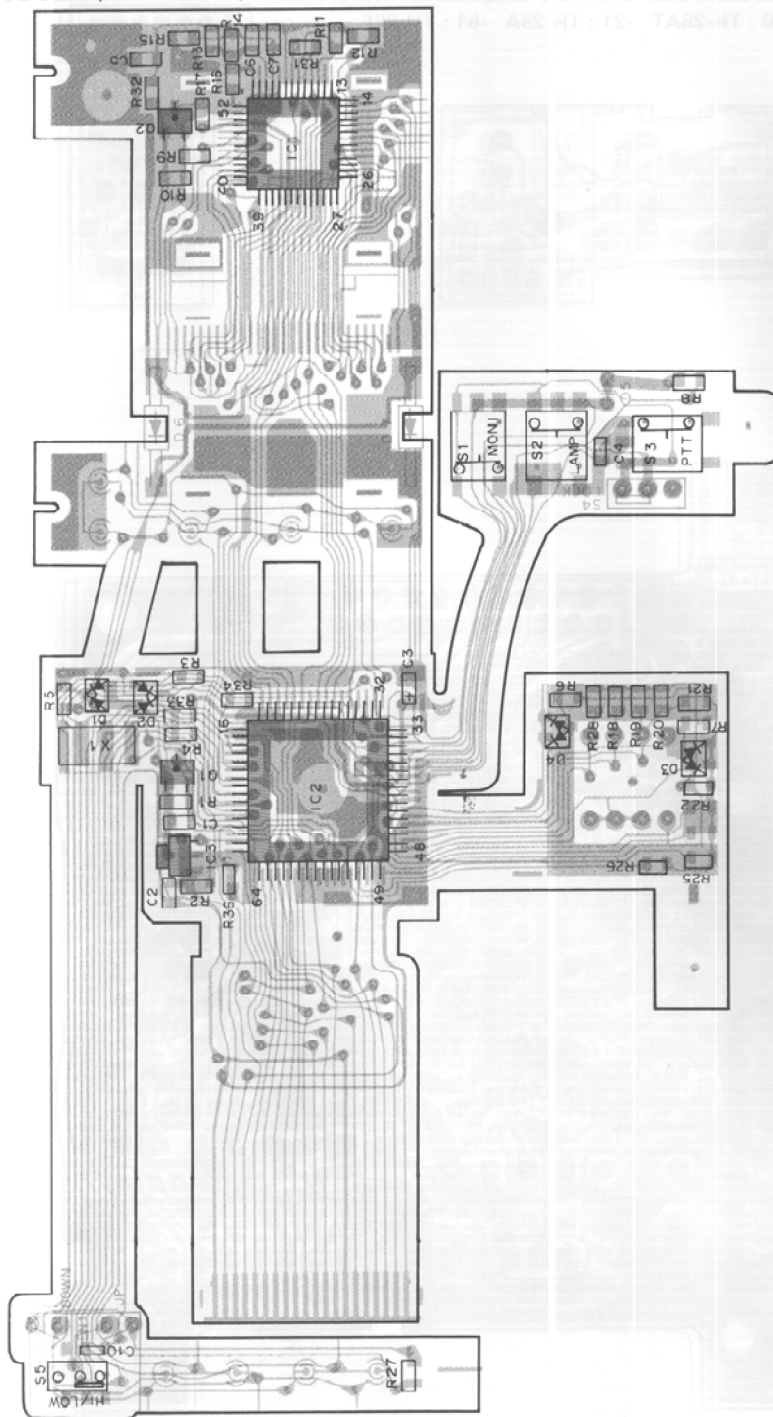


■ : Component side
□ : Foil side

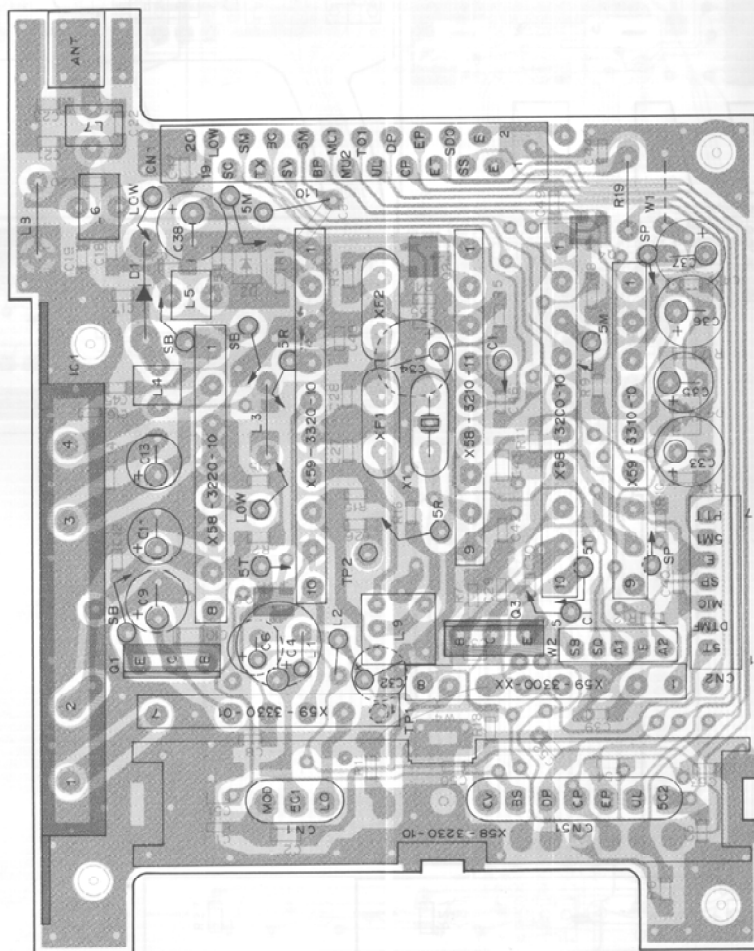
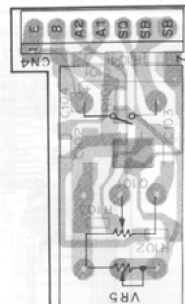
C1 : 25C2712(Y) C2 : 25A1162(Y)
IC1 : LH5008TP IC2 : 75108AG-018-22 (T,W, 75108AG-021-22 (K,M,M2,M3,M4,X))
IC3 : S8054ALR-LN
D1,2 : 1SS184 D3,4 : 1SS181

PC BOARD VIEWS TH-25A/AT/E

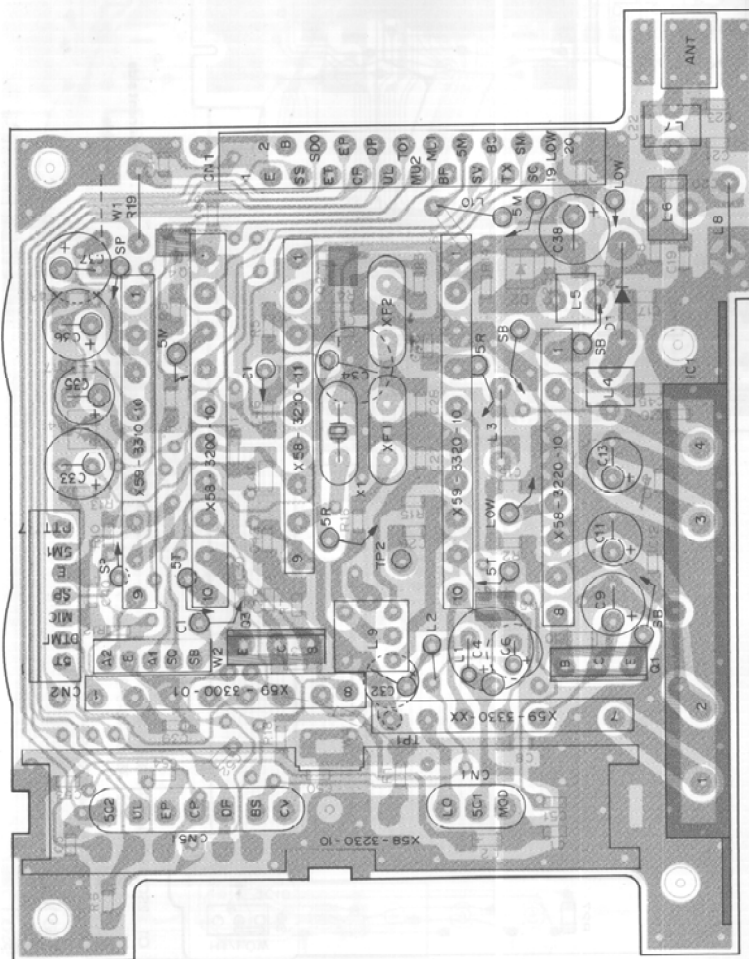
CONTROL UNIT (X53-3080-XX) Foil side view





-10 : TH-25AT -21 : TH-25A -61 : TH-25E



A diagram of a three-pin electrical plug. The pins are labeled B, C, and E. Pin B is the longest and is located at the bottom. Pin C is the shortest and is located on the left. Pin E is the medium length and is located on the right. The plug has a rectangular body with a small tab on top.



Q1.3 : 2SB1182(Q) Q2 : 2SC2714(O) Q4 : DTC143TU Q5 : DTC114EU Q9 : DTC143TK Q101 : 2SC4116(GR)
IC1 : M57196MA
D1 : M1303 D2 : HSK277 D4 : DAN202U

 : Component side
 : Foil side

Signal line

Control line

Common DC line

IC 1 LH5008TP
IC 2 uPD75108AG
IC 3 S8054ALR-LN

Q 1 2SC2712(Y)
Q 2 2SA1162(Y)

IC 1 M57796MA

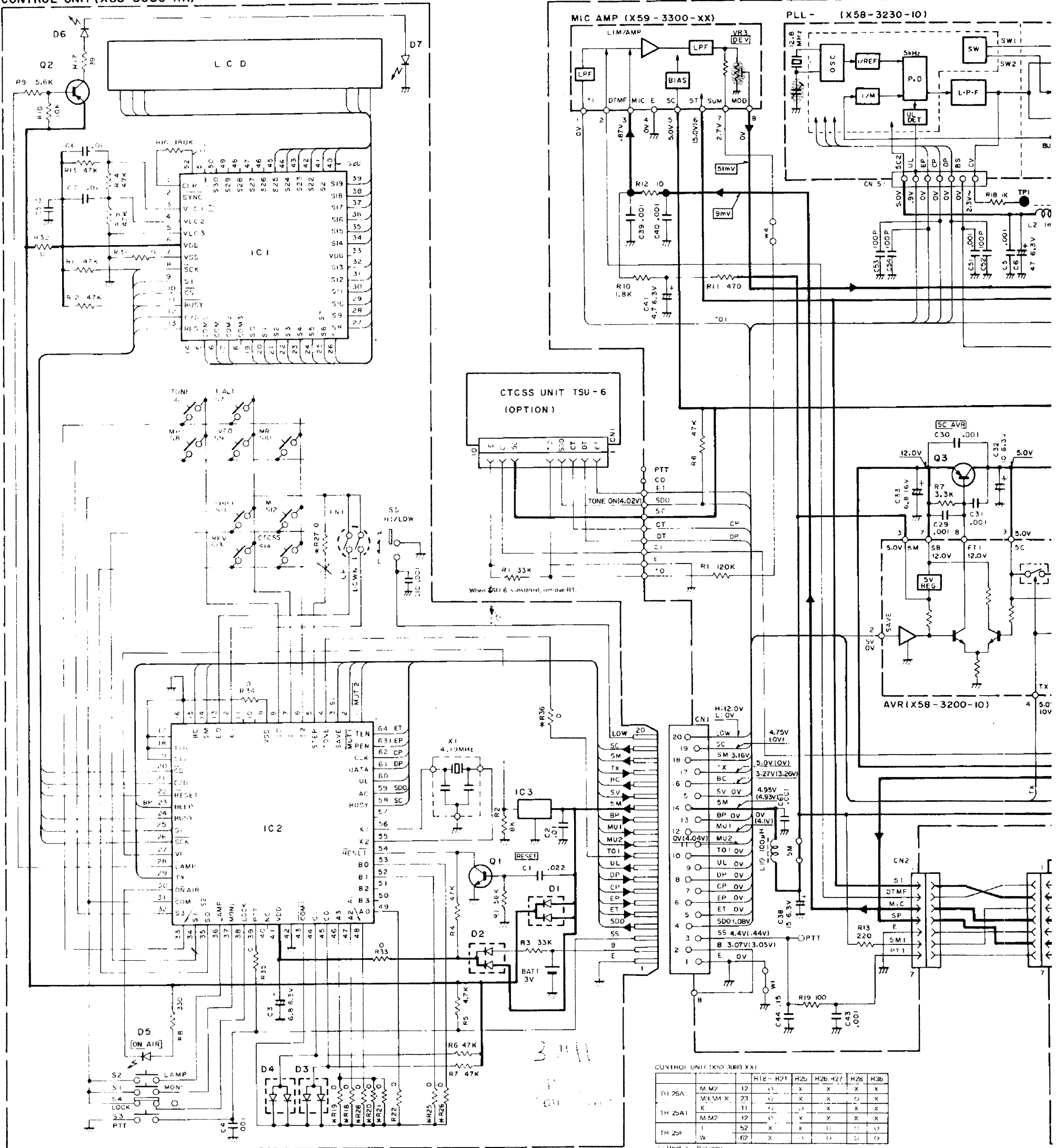
Q 1 2SB1182(Q)
Q 2 2SC2714(O)
Q 3 2SB1182(Q)
Q 4 DTC143TU
Q 5 DTC114EU
Q 9 DTC143TK

D 1 M1303
D 2 HSK277
D 4 DAN202U

TX-RX UNIT (X)	
TH-25A	-2
TH-25AT	-1
TH-25E	-6
D: Umd. X No	

CONTROL UNIT (X53-3080-XX)

TX-RX UNIT (X57-3160-XX) (A/3)



CONTROL UNIT (X53-3080-XX)

		H12-H21	H25	H26-H27	H28	H36
TH-25A	M.M2	12	()	X	X	X
TH-25AT	M.M2 X	23	()	X	X	X
TH-25E	K	11	()	X	X	X
TH-25F	M.M2	12	()	X	X	X
	I	52	X	X	()	()
	W	62	X	()	()	()

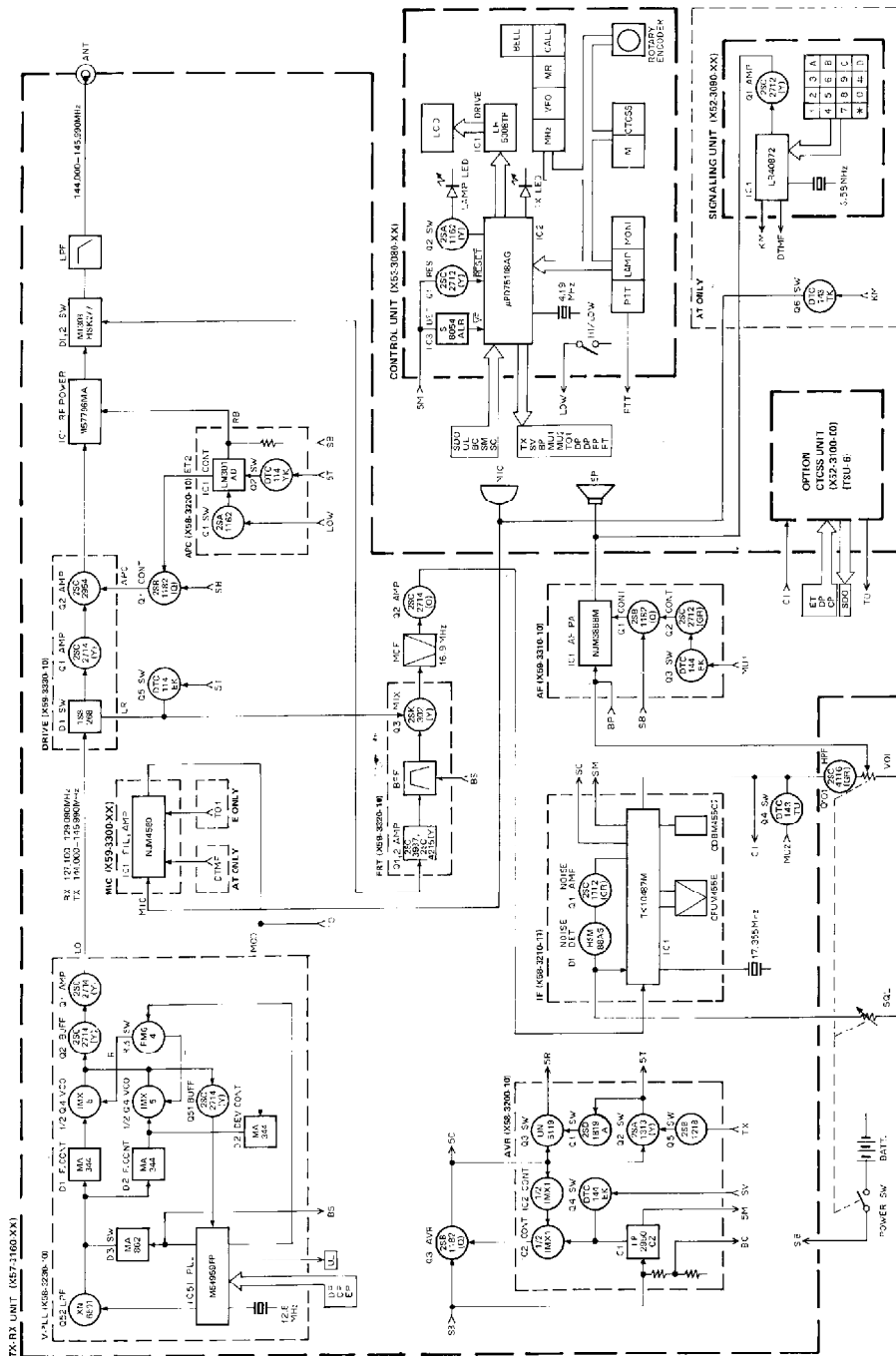
SCHEMATIC DIAGRAM TH-25A/AT/E

1303
SK277

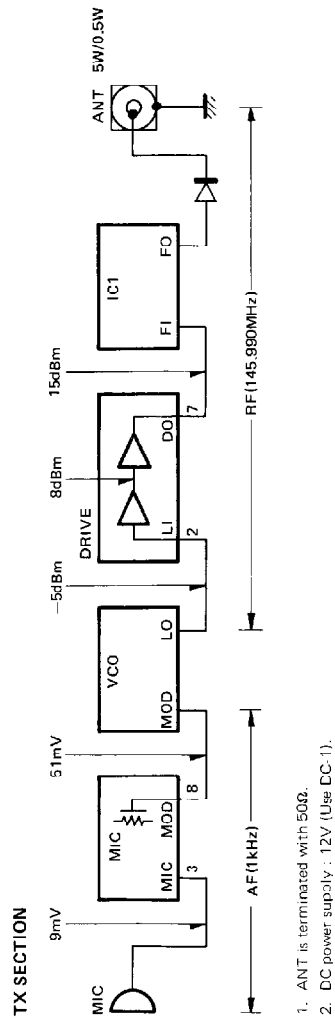
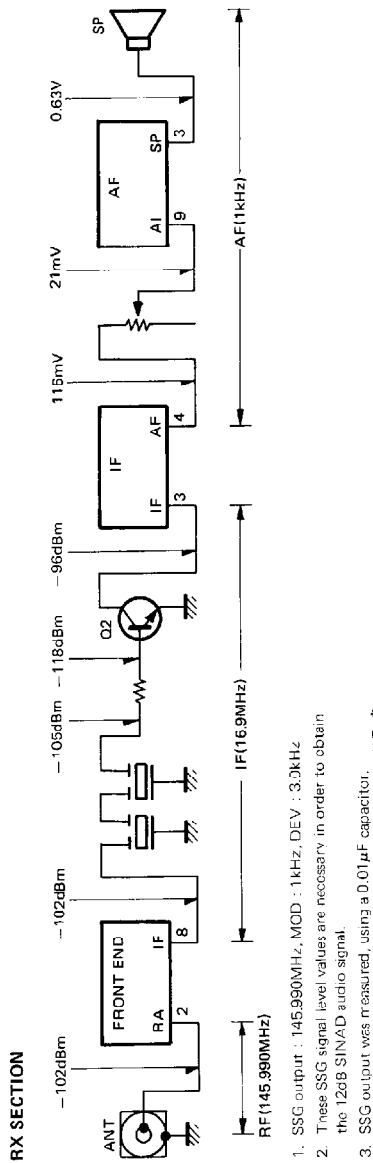
AN202U

TX-RX UNIT (X52-3100-XX)	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30	Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40	Q41	Q42	Q43	Q44	Q45	Q46	Q47	Q48	Q49	Q50	Q51	Q52	Q53	Q54	Q55	Q56	Q57	Q58	Q59	Q60	Q61	Q62	Q63	Q64	Q65	Q66	Q67	Q68	Q69	Q70	Q71	Q72	Q73	Q74	Q75	Q76	Q77	Q78	Q79	Q80	Q81	Q82	Q83	Q84	Q85	Q86	Q87	Q88	Q89	Q90	Q91	Q92	Q93	Q94	Q95	Q96	Q97	Q98	Q99	Q100	Q101	Q102	Q103	Q104	Q105	Q106	Q107	Q108	Q109	Q110	Q111	Q112	Q113	Q114	Q115	Q116	Q117	Q118	Q119	Q120	Q121	Q122	Q123	Q124	Q125	Q126	Q127	Q128	Q129	Q130	Q131	Q132	Q133	Q134	Q135	Q136	Q137	Q138	Q139	Q140	Q141	Q142	Q143	Q144	Q145	Q146	Q147	Q148	Q149	Q150	Q151	Q152	Q153	Q154	Q155	Q156	Q157	Q158	Q159	Q160	Q161	Q162	Q163	Q164	Q165	Q166	Q167	Q168	Q169	Q170	Q171	Q172	Q173	Q174	Q175	Q176	Q177	Q178	Q179	Q180	Q181	Q182	Q183	Q184	Q185	Q186	Q187	Q188	Q189	Q190	Q191	Q192	Q193	Q194	Q195	Q196	Q197	Q198	Q199	Q200	Q201	Q202	Q203	Q204	Q205	Q206	Q207	Q208	Q209	Q210	Q211	Q212	Q213	Q214	Q215	Q216	Q217	Q218	Q219	Q220	Q221	Q222	Q223	Q224	Q225	Q226	Q227	Q228	Q229	Q230	Q231	Q232	Q233	Q234	Q235	Q236	Q237	Q238	Q239	Q240	Q241	Q242	Q243	Q244	Q245	Q246	Q247	Q248	Q249	Q250	Q251	Q252	Q253	Q254	Q255	Q256	Q257	Q258	Q259	Q260	Q261	Q262	Q263	Q264	Q265	Q266	Q267	Q268	Q269	Q270	Q271	Q272	Q273	Q274	Q275	Q276	Q277	Q278	Q279	Q280	Q281	Q282	Q283	Q284	Q285	Q286	Q287	Q288	Q289	Q290	Q291	Q292	Q293	Q294	Q295	Q296	Q297	Q298	Q299	Q300	Q301	Q302	Q303	Q304	Q305	Q306	Q307	Q308	Q309	Q310	Q311	Q312	Q313	Q314	Q315	Q316	Q317	Q318	Q319	Q320	Q321	Q322	Q323	Q324	Q325	Q326	Q327	Q328	Q329	Q330	Q331	Q332	Q333	Q334	Q335	Q336	Q337	Q338	Q339	Q340	Q341	Q342	Q343	Q344	Q345	Q346	Q347	Q348	Q349	Q350	Q351	Q352	Q353	Q354	Q355	Q356	Q357	Q358	Q359	Q360	Q361	Q362	Q363	Q364	Q365	Q366	Q367	Q368	Q369	Q370	Q371	Q372	Q373	Q374	Q375	Q376	Q377	Q378	Q379	Q380	Q381	Q382	Q383	Q384	Q385	Q386	Q387	Q388	Q389	Q390	Q391	Q392	Q393	Q394	Q395	Q396	Q397	Q398	Q399	Q400	Q401	Q402	Q403	Q404	Q405	Q406	Q407	Q408	Q409	Q410	Q411	Q412	Q413	Q414	Q415	Q416	Q417	Q418	Q419	Q420	Q421	Q422	Q423	Q424	Q425	Q426	Q427	Q428	Q429	Q430	Q431	Q432	Q433	Q434	Q435	Q436	Q437	Q438	Q439	Q440	Q441	Q442	Q443	Q444	Q445	Q446	Q447	Q448	Q449	Q450	Q451	Q452	Q453	Q454	Q455	Q456	Q457	Q458	Q459	Q460	Q461	Q462	Q463	Q464	Q465	Q466	Q467	Q468	Q469	Q470	Q471	Q472	Q473	Q474	Q475	Q476	Q477	Q478	Q479	Q480	Q481	Q482	Q483	Q484	Q485	Q486	Q487	Q488	Q489	Q490	Q491	Q492	Q493	Q494	Q495	Q496	Q497	Q498	Q499	Q500	Q501	Q502	Q503	Q504	Q505	Q506	Q507	Q508	Q509	Q510	Q511	Q512	Q513	Q514	Q515	Q516	Q517	Q518	Q519	Q520	Q521	Q522	Q523	Q524	Q525	Q526	Q527	Q528	Q529	Q530	Q531	Q532	Q533	Q534	Q535	Q536	Q537	Q538	Q539	Q540	Q541	Q542	Q543	Q544	Q545	Q546	Q547	Q548	Q549	Q550	Q551	Q552	Q553	Q554	Q555	Q556	Q557	Q558	Q559	Q560	Q561	Q562	Q563	Q564	Q565	Q566	Q567	Q568	Q569	Q570	Q571	Q572	Q573	Q574	Q575	Q576	Q577	Q578	Q579	Q580	Q581	Q582	Q583	Q584	Q585	Q586	Q587	Q588	Q589	Q590	Q591	Q592	Q593	Q594	Q595	Q596	Q597	Q598	Q599	Q600	Q601	Q602	Q603	Q604	Q605	Q606	Q607	Q608	Q609	Q610	Q611	Q612	Q613	Q614	Q615	Q616	Q617	Q618	Q619	Q620	Q621	Q622	Q623	Q624	Q625	Q626	Q627	Q628	Q629	Q630	Q631	Q632	Q633	Q634	Q635	Q636	Q637	Q638	Q639	Q640	Q641	Q642	Q643	Q644	Q645	Q646	Q647	Q648	Q649	Q650	Q651	Q652	Q653	Q654	Q655	Q656	Q657	Q658	Q659	Q660	Q661	Q662	Q663	Q664	Q665	Q666	Q667	Q668	Q669	Q670	Q671	Q672	Q673	Q674	Q675	Q676	Q677	Q678	Q679	Q680	Q681	Q682	Q683	Q684	Q685	Q686	Q687	Q688	Q689	Q690	Q691	Q692	Q693	Q694	Q695	Q696	Q697	Q698	Q699	Q700	Q701	Q702	Q703	Q704	Q705	Q706	Q707	Q708	Q709	Q710	Q711	Q712	Q713	Q714	Q715	Q716	Q717	Q718	Q719	Q720	Q721	Q722	Q723	Q724	Q725	Q726	Q727	Q728	Q729	Q730	Q731	Q732	Q733	Q734	Q735	Q736	Q737	Q738	Q739	Q740	Q741	Q742	Q743	Q744	Q745	Q746	Q747	Q748	Q749	Q750	Q751	Q752	Q753	Q754	Q755	Q756	Q757	Q758	Q759	Q760	Q761	Q762	Q763	Q764	Q765	Q766	Q767	Q768	Q769	Q770	Q771	Q772	Q773	Q774	Q775	Q776	Q777	Q778	Q779	Q780	Q781	Q782	Q783	Q784	Q785	Q786	Q787	Q788	Q789	Q790	Q791	Q792	Q793	Q794	Q795	Q796	Q797	Q798	Q799	Q800	Q801	Q802	Q803	Q804	Q805	Q806	Q807	Q808	Q809	Q810	Q811	Q812	Q813	Q814	Q815	Q816	Q817	Q818	Q819	Q820	Q821	Q822	Q823	Q824	Q825	Q826	Q827	Q828	Q829	Q830	Q831	Q832	Q833	Q834	Q835	Q836	Q837	Q838	Q839	Q840	Q841	Q842	Q843	Q844	Q845	Q846	Q847	Q848	Q849	Q850	Q851	Q852	Q853	Q854	Q855	Q856	Q857	Q858	Q859	Q860	Q861	Q862	Q863	Q864	Q865	Q866	Q867	Q868	Q869	Q870	Q871	Q872	Q873	Q874	Q875	Q876	Q877	Q878	Q879	Q880	Q881	Q882	Q883	Q884	Q885	Q886	Q887	Q888	Q889	Q890	Q891	Q892	Q893	Q894	Q895	Q896	Q897	Q898	Q899	Q900	Q901	Q902	Q903	Q904	Q905	Q906	Q907	Q908	Q909	Q910	Q911	Q912	Q913	Q914	Q915	Q916	Q917	Q918	Q919	Q920	Q921	Q922	Q923	Q924	Q925	Q926	Q927	Q928	Q929	Q930	Q931	Q932	Q933	Q934	Q935	Q936	Q937	Q938	Q939	Q940	Q941	Q942	Q943	Q944	Q945	Q946	Q947	Q948	Q949	Q950	Q951	Q952	Q953	Q954	Q955	Q956	Q957	Q958	Q959	Q960	Q961	Q962	Q963	Q964	Q965	Q966	Q967	Q968	Q969	Q970	Q971	Q972	Q973	Q974	Q975	Q976	Q977	Q978	Q979	Q980	Q981	Q982	Q983	Q984	Q985	Q986	Q987	Q988	Q989	Q990	Q991	Q992	Q993	Q994	Q995	Q996	Q997	Q998	Q999	Q1000	Q1001	Q1002	Q1003	Q1004	Q1005	Q1006	Q1007	Q1008	Q1009	Q1010	Q1011	Q1012	Q1013	Q1014	Q1015	Q10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BLOCK DIAGRAM



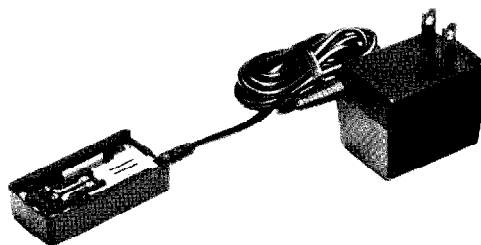
LEVEL DIAGRAM



TERMINAL FUNCTIONS/BC-9 (BATTERY CHARGER)

Connector No.	Terminal No.	Terminal Name	Function
TX-RX UNIT (A/3) — CONTROL UNIT			
CN1	1	E	Ground.
	2	B	Not used.
	3	SS	PTT SW signal. "L" : TX, "H" : RX.
	4	SDO	Tone signal match/mismatch identification signal.
	5	ET	Tone enable.
	6	EP	PLL enable.
	7	CP	Clock signal.
	8	DP	PLL, tone serial data.
	9	UL	PLL unlock signal.
	10	TO1	1750Hz tone signal. TH-25E
	11	MU2	Mute signal. "H" : Mute.
	12	MU1	Mute signal. "H" : Mute.
	13	BP	Beep signal.
	14	5M	5V power supply for μ -com and mic.
	15	SV	SAVE signal output.
			"L" : Save, "H" : Normal.
	16	BC	Battery voltage check signal.
	17	TX	Transmit/receive switching signal.
			"L" : TX, "H" : RX.
	18	SM	S-meter signal.
	19	SC	Busy signal.
	20	LOW	High/Low power switching signal.
TX-RX UNIT (A/3) — TSU-6			
	1	ET	Tone enable.
	2	DP	Tone serial data.
	3	CP	Clock signal.
	4	TO	Tone output.
	5	PTT	Not used.
	6	SDO	Tone signal match/mismatch identification signal.
	7	CO	Not used.
	8	5C	5V power supply.
	9	CI	Audio signal input.
	10	E	Ground.
TX-RX UNIT (A/3) — TX-RX UNIT (C/3)			
CN2	1	5T	5V power supply for transmit.
	2	DTMF	DTMF signal. TH-25AT
	3	MIC	Signal line from microphone.
	4	SP	Signal line to built in speaker.
	5	E	Ground.
	6	5M	5V power supply for μ -com and mic.
	7	PTT	External standby line.
TX-RX UNIT (A/3) — TX-RX UNIT (B/3)			
W2	1	A2	AF volume input line.
	2	E	Ground.
	3	A1	AF amplifier input line.
	4	SQ	Squelch volume input line.
	5	SB	B power supply after power switch.
TX-RX UNIT (C/3)			
W3	1	KM	Mic mute signal. TH-25AT
	2	F	Ground.
	3	SP	Audio output.
	4	5T	5V power supply for transmit.
	5	DTMF	DTMF signal. TH-25AT

BC-9 EXTERNAL VIEW



BC-9 PARTS LIST

* : New Parts

Ref. No.	New Parts	Parts No.	Description
		A02-0814-03	Case (Charge adapter)
		E23-0494-04	Terminal
		E23-0605-04	Terminal
		J19-1426-03	Terminal holder

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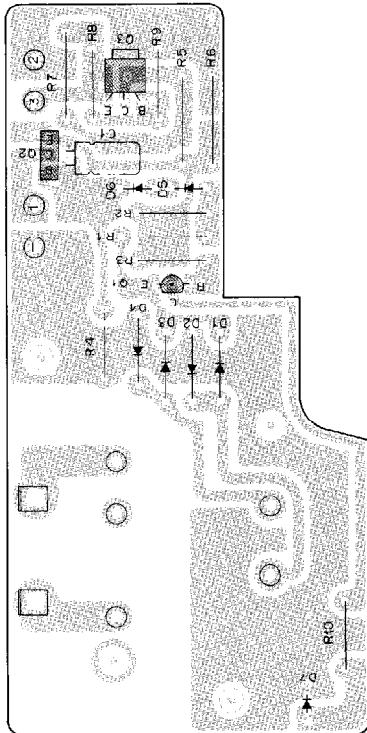
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BC-10 (COMPACT CHARGER)

BC-10 EXTERNAL VIEW



BC-10 PC BOARD VIEW

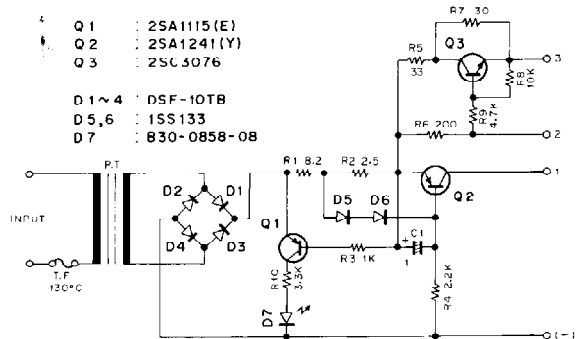


BC-10 PARTS LIST

* : New Parts

Ref. No.	New Parts	Parts No.	Description
D7	*	A02-0828-08	Case (Upper) K,M,M2
	*	A02-0829-08	Case (Upper) X,T,W
	*	A02-0832-08	Case (Lower)
	*	B30-0858-08	LED SR615D
	*	B50-8203-08	Instruction manual K,M,M2,X,W
	*	B50-8204-08	Instruction manual T
	*	E30-2097-08	AC power cord K,M,M2
	*	E30-2098-08	AC power cord X
	*	E30-2000-08	AC power cord T
	*	E30-2100-08	AC power cord W
Q1	*	L01-8027-08	Power transformer 220V M,W
	*	L01-8111-08	Power transformer 120V K,M2
	*	L01-8152-08	Power transformer 240V X,I
Q2	*	W02-0805-08	Module
	*	2SA1115(E)	Transistor
	*	2SA1241(Y)	Transistor
Q3	*	2SC3076	Transistor
D1-4	*	DSF-10TB	Diode
	*	1SS133	Diode

BC-10 CIRCUIT DIAGRAM



BC-11 (RAPID CHARGER)

BC-11 EXTERNAL VIEW



BC-11 CIRCUIT DESCRIPTION

General

The BC-11 is a rapid charger for the PB-5 to PB-9 Ni-Cd batteries for the TH-25 and TH-45.

Theory of Operation

The operation of each block is explained below.

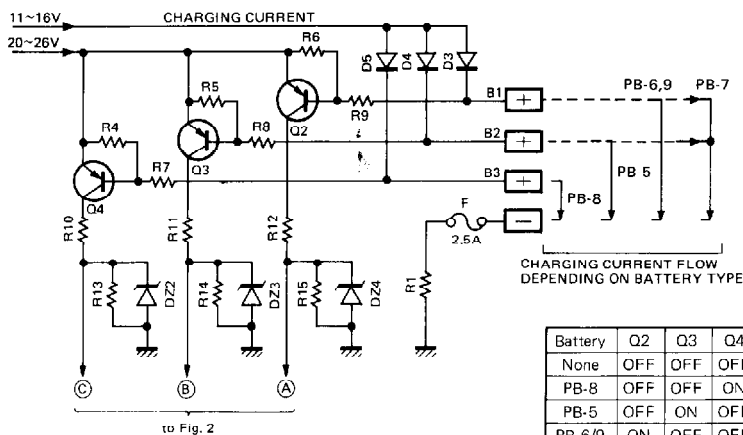
1) +11V AVR Circuit

This AVR circuit, consisting of a 2SD600F transistor (Q1) and DZA11Y Zener diode (DZ1) provides an output of approximately +11V as the reference voltage for the charging circuit consisting of IC2 to IC5.

2) Battery Pack Detect Circuit

This circuit detects whether a battery pack is inserted in the charger. Outputs from this circuit are routed to the reset circuit and the battery recognition circuit.

When a PB-6 or PB-9 is inserted in the charger, a small amount of current flows from Q2 : 2SA608E through R9 to the charging terminal B1 and Q2 turns on. As a result, an output of approximately 11V appears at (A) in Figure 1. Similarly when a PB-5 or PB-7 is inserted Q3 : 2SA608E turns on and approximately 11V is provided at output (B). When a PB-8 is inserted Q4 : 2SA608E turns on and approximately 11V is provided at output (C).



Battery	Q2	Q3	Q4
None	OFF	OFF	OFF
PB-8	OFF	OFF	ON
PB-5	OFF	ON	OFF
PB-6/9	ON	OFF	OFF
PB-7	ON	ON	OFF

Table 1

Fig. 1 Battery Pack Detect Circuit Block Diagram

BC-11 (RAPID CHARGER)

3) Reset Circuit/Charge Status Memory Circuit/ Display Circuit

The reset circuit initializes the charging status memory circuit.

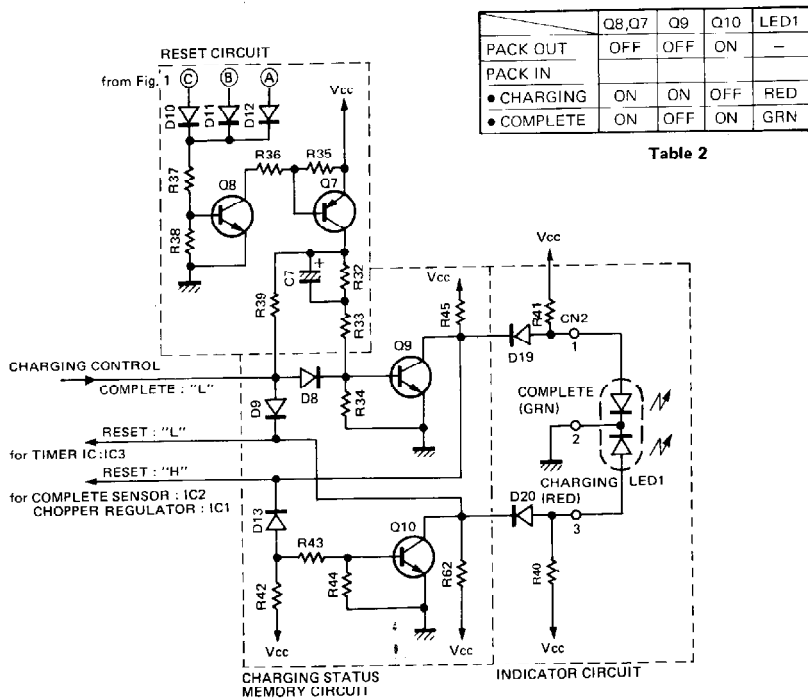


Fig. 2 Reset Circuit/Charge Status Memory Circuit/Display Circuit Block Diagram

The charge status memory circuit is an R-S flip-flop configured from transistors and resistors. The two states of the flip-flop are called COMPLETE and CHARGING. Outputs from the flip-flop drive the LED in the indicator circuit and reset the timer, complete sensor, and chopper regulator. In the COMPLETE state Q9 : 2SC536E is off and Q10 : 2SC536E is on. In the CHARGING state Q9 is on and Q10 is off.

When a battery pack is not inserted, Q8 : 2SC536E and Q7 : 2SC536E turn off. As there is no base voltage to Q9, Q9 also turns off. The base of Q10 receives enough bias from Vcc to turn on, resulting in 0V at the collector. The current flow through R41 to the COMPLETE indicator in LED1 which glows green, because of Q9 if off.

When the battery pack is inserted Q8 and Q7 turn on. As soon as Q7 turns on, charging current flows through R33, R34, and Q9 to C7 and Q9 turns on. The base voltage of Q10, which is connected to Q9 through diode D13, then drops and Q10 turns off. Since Q10 is off, current flows through R40 to the CHARGING indicator in LED1, which glows red to indicate that the battery is charging. When charging of C7 is completed, on-current continues to flow to the base of Q9 through R39 and D8.

When charging is completed the complete sensor (IC2) outputs a Low ("L") signal that ends the flow of current to the base of Q9, turning Q9 off. As a result current flows through R41 to the COMPLETE indicator in LED1, which glows green to indicate that charging is complete.

BC-11 (RAPID CHARGER)

6) Sensor Level Switching Circuit

This circuit receives the output of the battery recognition circuit and aligns the voltages supplied to the charging status detect circuit according to the battery type (voltage) so that they are nearly equal at completion of charging.

	SHIFT Es(V)	Q11	Q12
PB-5	2.0	ON	OFF
PB-6	2.0	OFF	ON
PB-7	2.0	OFF	ON
PB-8	7.6	OFF	OFF
PB-9	2.0	OFF	ON

Table 5

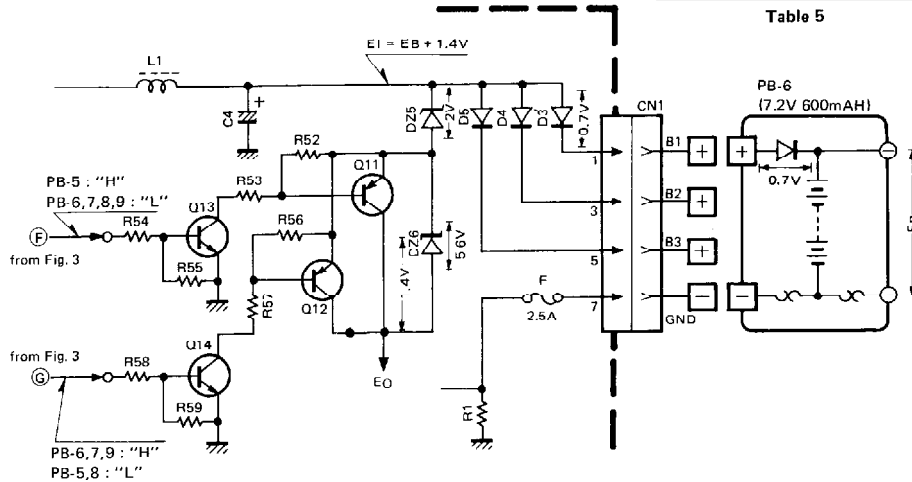


Fig. 5 Sensor Level Switching Circuit Block Diagram

The pin voltages while the Ni-Cd battery is charging are approximately 1.2 times the voltages at the completion of charging. (See Figure 6.)

The battery terminal voltage EB is as follows:

Approximately 14.4V for the PB-8

Approximately 8.0V for the PB-5, 6, 7, 9

The charging line voltage EI is the EB voltage plus a 1.4V voltage drop added by a diode.

$$EI = EB + 1.4V \dots (1)$$

The EI voltage is output with a level shift as the voltage EO to the charging status detect circuit via Zener diode DZ6 and diodes D17 and D18. The amount of the shift is controlled by switching Q11 : 2SA608E and Q12 : 2SA608E on and off. (See Table 5.) If Eq. (1) is substituted into EO in Table 5, the results are:

$$PB-8 : EO = EB - 6.2V$$

$$PB-5, 6, 7, 9 : EO = EB - 0.6V$$

At the completion of charging the value is approximately 8V.



Fig. 6 The pin voltages while the Ni-CD Battery is charging

BC-11 (RAPID CHARGER)

7) Charging Status Detect Circuit

This circuit detects the completion of charging and outputs a signal to stop charging. When no battery pack is inserted or charging is completed, a High ("H") Reset signal is applied to D15. When a battery is inserted the Reset signal applied to D15 is cleared. When the Reset signal is cleared, pin 4 of IC2 : KCH-1003 holds the reset state due to the charge in C8 for the duration of the R46-C8 time constant, then goes "L" to clear the reset state. Pins 8 and 9 of IC2 receive divided portions of the battery voltage. These inputs are tracked as the charging is performed in the long-term memory capacitor "MD". As the Ni-Cd battery charges, the battery voltage reaches a peak, then declines. (See Figure 6.) The MD stores the peak voltage, which is compared with the divided voltages at pins 8 and 9. When the difference ΔV is the same, a "L" signal is output from pin 11 to indicate that charging is complete. The signal indicating completion of charging is applied to the charging status memory circuit.

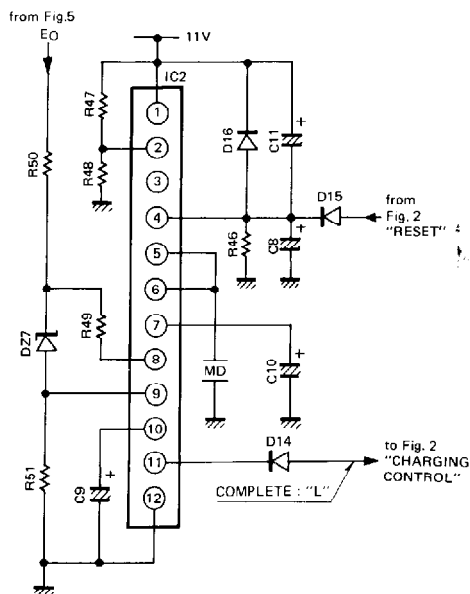


Fig. 7 Charging Status Detect Circuit Block Diagram

8) Timer Circuit

Battery defects may result in charging continuing indefinitely without completion, so this timer outputs a signal that stops charging approximately 1.7 hours after charging begins. When charging begins and the Reset signal is cleared at pin 3, IC3 : AN6780 begins counting. At the first count of 16384 pin 6 goes from "H" to "L". The output from pin 6 is connected to the Stop input (pin 2), so the output of IC3 is held in the "L" state until IC3 receives another Reset signal (for example, when the battery is removed).

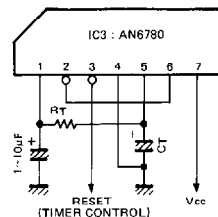


Fig. 8 Timer Circuit Block Diagram

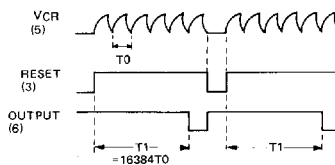


Fig. 9

9) Voltage Comparator Circuit

This circuit monitors the output (EO) of the sensor level switching circuit and indirectly detects abnormal conditions in the battery pack connected to the charging terminal. When the EO voltage falls to 5.2V or lower, the charging control line goes "L" to halt charging.

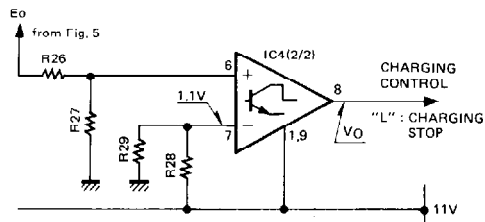


Fig. 10 Voltage Comparator Circuit Block Diagram



Fig. 11

BC-11 (RAPID CHARGER)

※ New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés dans le Parts No. ne sont pas fournis.

Teile ohne Parts No. werden nicht geliefert.

BC-11 PARTS LIST

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕向	Re- marks 備考
BC-11						
1	1A	*	A02-0815-08	CASE		
2	1A,1B	*	A02-0817-08	BATTERY POCKET		
3	1B		B46-0411-00	WARRANTY CARD	K	
4	1B	*	B50-8134-08	INSTRUCTION MANUAL		
5	1B	*	E23-0604-05	TERMINAL		
△ 6	2A		E30-2038-08	AC CORD	K,M,M2	
△ 6	2A		E30-2072-08	AC CORD	W	
△ 6	2A		E30-2073-08	AC CORD	T	
△ 6	2A		E30-2095-08	AC CORD	X	
8	2B	*	H01-8128-08	ITEM CARTON CASE		
9	2B		H10-2584-02	POLYSTYRENE FOAMED FIXTURE (L)		
10	2B		H10-2585-02	POLYSTYRENE FOAMED FIXTURE (R)		
11	3A		J02-0439-05	FOOT		
12	3A		J39-0424-05	SPACER		
△ T1	2A		L01-8081-08	POWER TRANSFORMER (AC120V)	K,M2	
△ T1	2A		L01-8112-08	POWER TRANSFORMER (AC220V)	M,W	
△ T1	2A		L01-8122-08	POWER TRANSFORMER (AC240V)	T,X	
A	3A		N30-3006-41	MACHINE SCREW (M3 X 6)		
B	2A,1B		N34-4006-46	MACHINE SCREW (M4 X 6 TR)		
C	2A,1B		N35-4006-45	MACHINE SCREW (M4 X 6 BI) BLK		
D	2A		N87-3008-46	TAPTITE SCREW (φ3 X 8 BR)		
E	1A		N89-3008-45	TAPTITE SCREW (φ3 X 8 BI) BLK		
SW1	3A		S36-1407-05	POWER SW		
/	3B	*	W02-0399-08	CHARGE CONTROL UNIT		
CHARGE CONTROL UNIT (W02-0399-08)						
C1			CE04EW1V222M	ELECTRO 2200μF 35WV		
C2			CE04EW1C470M	ELECTRO 47μF 16WV		
C3			CE04EW1H010M	ELECTRO 1μF 50WV		
C4			CE04EW1E471M	ELECTRO 470μF 25WV		
C5,6			CE04EW1C100M	ELECTRO 10μF 16WV		
C7			CE04EW1A101M	ELECTRO 100μF 10WV		
C8			CE04EW1C100M	ELECTRO 10μF 16WV		
C9,10			CE04EW0J101M	ELECTRO 100μF 6.3WV		
C11			CE04EW1C330M	ELECTRO 33μF 16WV		
C12			CK45B1H102K	CERAMIC 0.001μF 50WV		
C14			CE04EW1H010M	ELECTRO 1μF 50WV		

E: Scandinavia & Europe H: Audio Club K: USA P: Canada W: Europe

A: Saudi Arabia T: England U: PX (Far East, Hawaii)

UE: AAFES (Europe) X: Australia M: Other Areas

△ indicates safety critical components.

BC-11 (RAPID CHARGER)

* New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés dans le Parts No. ne sont pas fournis.

Teile ohne Parts No. werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名 / 規格	Desti- nation 仕向	Re- marks 備考
MD			C91-1038-08	ELECTRO		
△ F1			F05-2525-05	FUSE (2.5A)	W,X	
△ F1			F06-2522-05	FUSE (2.5A)	M,M2,T	
△ F1			F06-2523-05	FUSE (2.5A)	K	
			J13-0039-05	FUSE HOLDER	W	
I 1			L33-0694-08	CHOKE COIL (470μH)		
R1			R92-0683-08	FL-PROOF 0.15Ω 4W		
D1-5			DSA26B	DIODE		
D6-16			DS442	DIODE		
D19-21			DS442	DIODE		
DZ1			GZA11Y	ZENER DIODE (11V)		
DZ2-4			GZA10Z	ZENER DIODE (10V)		
DZ5			GZA2.0X	ZENER DIODE (2V)		
DZ6			GZA5.6X	ZENER DIODE (5.6V)		
DZ7			GZA7.5Y	ZENER DIODE (7.5V)		
DZ8			GZA3.0X	ZENER DIODE (3V)		
IC1			STK772B	IC (CHOPPER REGULATOR)		
IC2			KCH-1003	IC (VOLTAGE SENSOR)		
IC3			AN6780	IC (TIMER)		
IC4			LA6393S	IC (DUAL OP IC)		
IC5			LC4011B	IC (QUADRUPLE NAND GATE)		
Q1			2SD600F,KF	TRANSISTOR		
Q2-5			2SA608E,F	TRANSISTOR		
Q6			2SC536E,F	TRANSISTOR		
Q7			2SA608E,F	TRANSISTOR		
Q8-10			2SC536E,F	TRANSISTOR		
Q11,12			2SA608E,F	TRANSISTOR		
Q13,14			2SC536E,F	TRANSISTOR		
LED1	2A		SLP-540D	LCD (RED/GRN)		

E: Scandinavia & Europe H: Audio Club K: USA P: Canada W: Europe

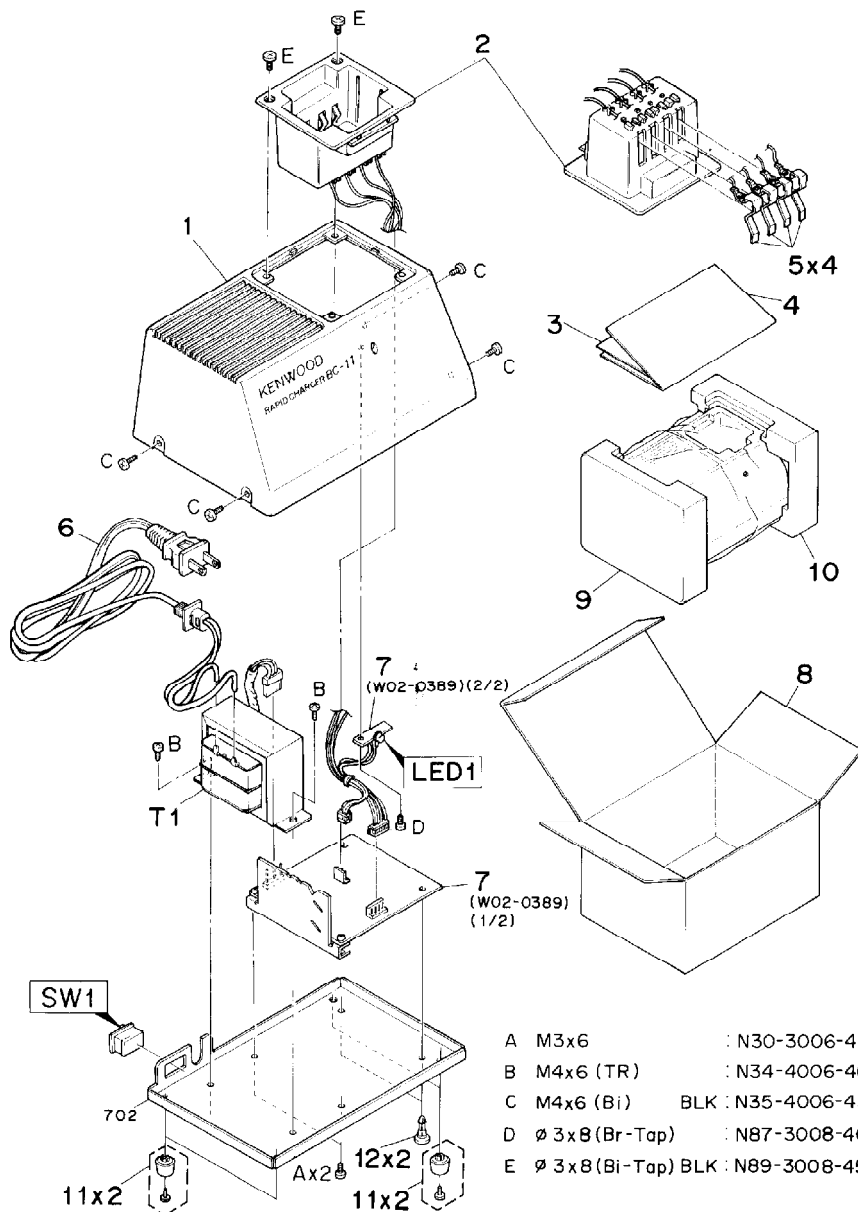
A: Saudi Arabia T: England U: PX (Far East, Hawaii)

UE: AAFES (Europe) X: Australia M: Other Areas

△ indicates safety critical components.

BC-11 (RAPID CHARGER)

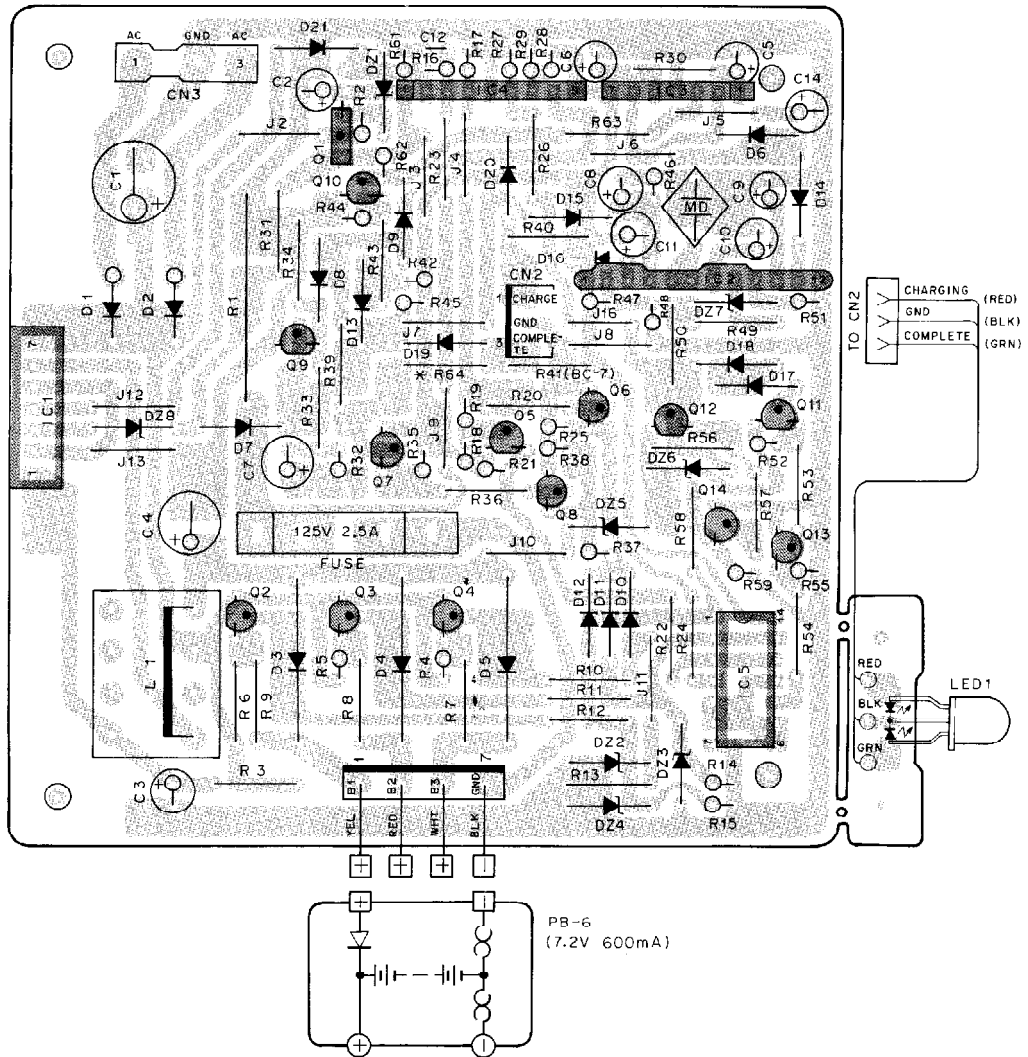
BC-11 DISASSEMBLY/PACKING



- | | | | |
|---|--------------------|-----|-------------|
| A | M3x6 | : | N30-3006-41 |
| B | M4x6 (TR) | : | N34-4006-46 |
| C | M4x6 (Bi) | BLK | N35-4006-45 |
| D | ∅ 3x8 (Br-Tap) | : | N87-3008-46 |
| E | ∅ 3x8 (Bi-Tap) BLK | : | N89-3008-45 |

BC-11 (RAPID CHARGER)

BC-11 PC BOARD VIEW



Q1: 2SD600F,KF Q2-5,7,11,12: 2SA608E,F Q6,8-10,13,14: 2SC536E,F
 IC1: STK772B IC2: KCH-1003 IC3: AN6780 IC4: LA6393S IC5: LC4011B
 D1-5: DSA26B D6-16,19-21: DS442
 D71: GZA11Y D22-4: GZA10Z D25: GZA2,0X D26: GZA5,6X D77: GZA7,5Y D78: GZA3,0X

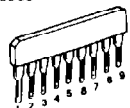
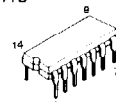
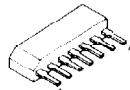
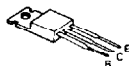
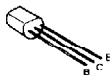
2SA608E
 2SA608F

2SC536E 2SD600F
 2SC536F 2SD600KF

AN6780

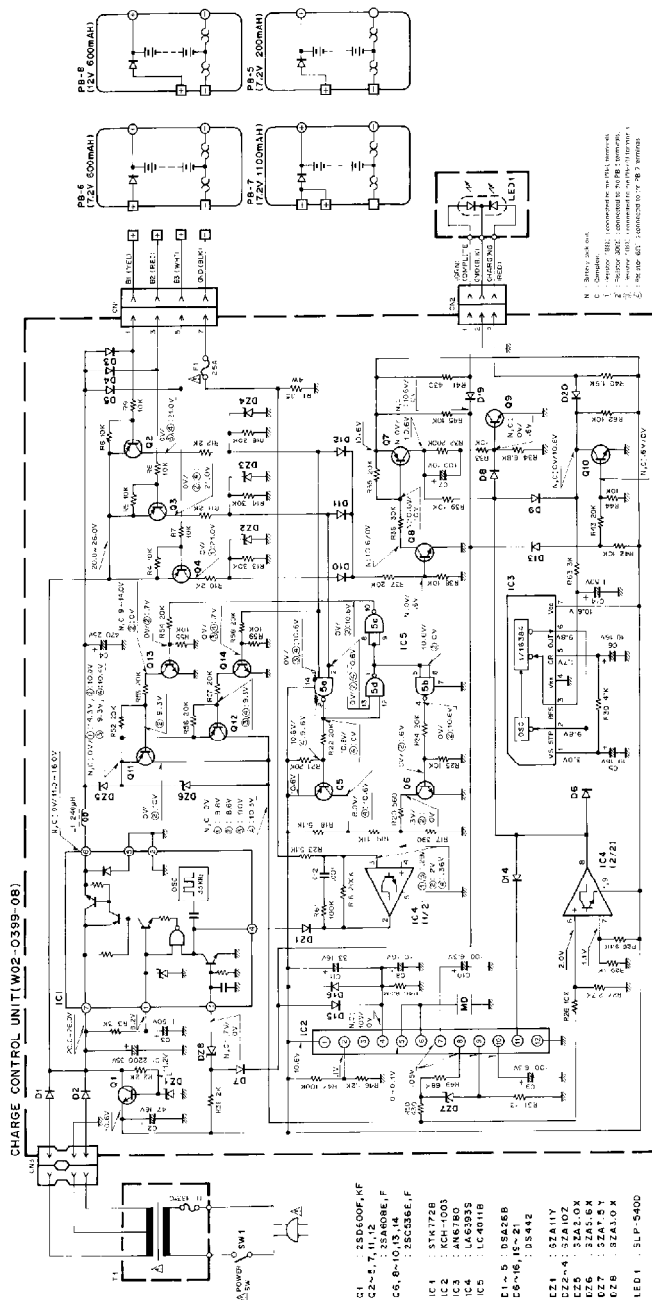
LC4011B

LA6393S



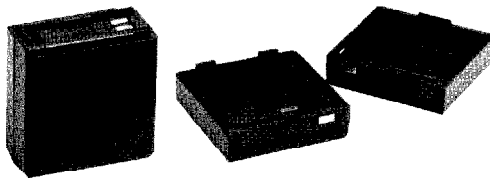
BC-11 (RAPID CHARGER)

BC-11 CIRCUIT DIAGRAM



BT-6 (AAA MANGANESE/ALKALINE BATTERY CASE)/ DC-1 (DC ADAPTER)

BT-6 EXTERNAL VIEW

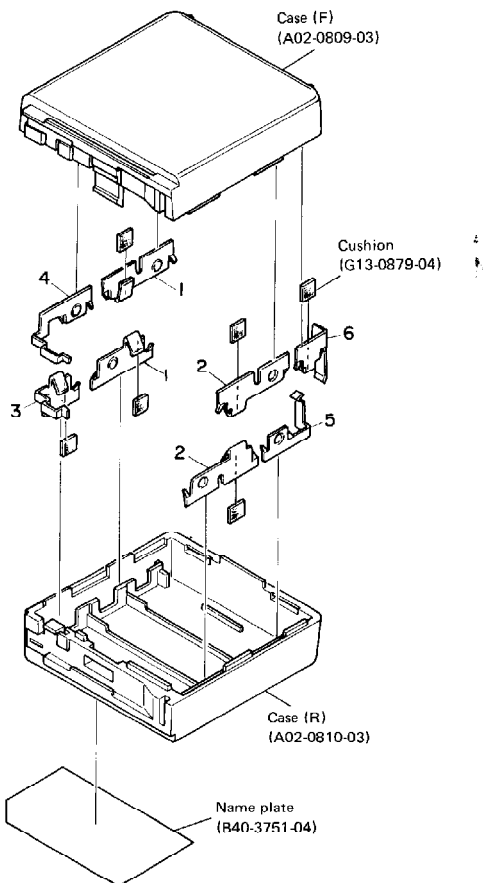


BT-6 PARTS LIST

* : New Parts

Ref. No.	New Parts	Parts No.	Description
1	*	E23-0496-04	Terminal A
2	*	E23-0497-04	Terminal B
3	*	E23-0498-04	Terminal C
4	*	E23-0499-04	Terminal D
5	*	E23-0500-04	Terminal E
6	*	E23-0601-04	Terminal F

BT-6 DISASSEMBLY



DC-1 EXTERNAL VIEW

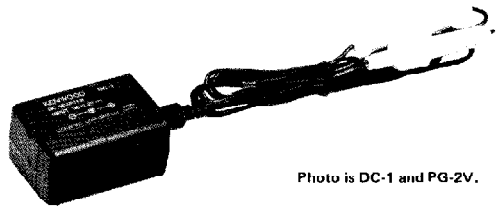


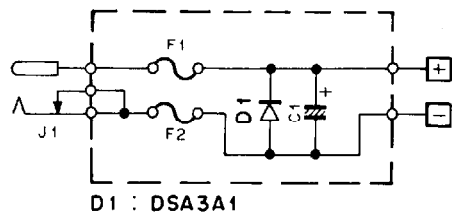
Photo is DC-1 and PG-2V.

DC-1 PARTS LIST

* : New Parts

Ref No.	New Parts	Parts No.	Description
C1		CW04EW1C102M	Electro 1000μF 16WV
J1		F03-0165-05	DC jack
		F06-3026-05	Fuse (3A)
	*	J13-0410-05	Fuse holder
D1		DSA3A1	Diode

DC-1 CIRCUIT DIAGRAM



DC-1 SPECIFICATIONS

Electrical characteristic

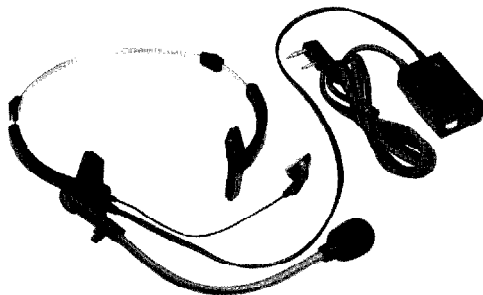
Max. input voltage 16V
Max. current 2A

Dimensions 58 W x 36.5 H x 29.5 D (mm)

Weight 40g

HMC-2 (HEAD SET WITH VOX & PTT)

HMC-2 EXTERNAL VIEW



HMC-2 PARTS LIST

* : New Parts

Ref. No.	New Parts	Parts No.	Description
VR1	*	A02-0840-08	Case (Front)
	*	A02-0841-08	Case (Rear)
	*	E30-2088-08	Cable with plug
	*	F09-0418-08	Microphone pad
	*	F09-0419-08	Ear pad
	*	J29-0427-08	Clip
	*	R05-4422-08	Potentiometer 50k Ω
	*	S31-1416-08	Slide switch PTT/VOX
	*	S50-1413-05	Tact switch PTT
	*	T18-0056-08	Earphone with cable
S1 S2	*	T91-0373-08	Microphone
	*	W02-0806-08	VOX/PTT unit
	*		
Q1	*	FMG2	Digital transistor
Q2	*	FMW2	Digital transistor
Q3	*	2SC2712(GR)	Chip transistor
IC 1	*	NJM2072M	IC
D1	*	1SS133	Diode

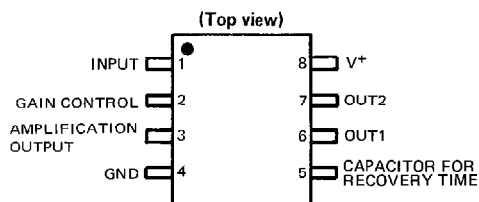
HMC-2 SPECIFICATIONS

Electrical characteristic

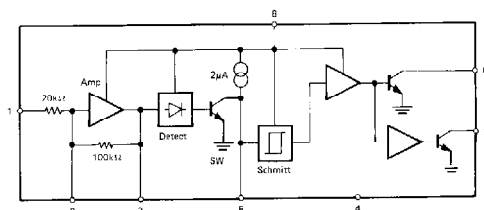
- **Earphone**
 - Diameter $\phi 19$
 - Impedance 19Ω (1000Hz)
 - Max. input power 50mW
- **Microphone**
 - Output sensitivity -70dB ($0\text{dB} = 1\text{V}/\mu\text{bar}$ 1000Hz)
 - Output impedance $1.6\text{k}\Omega$ (1000Hz)

HMC-2 SEMICONDUCTOR DATA

• Terminal connection diagram



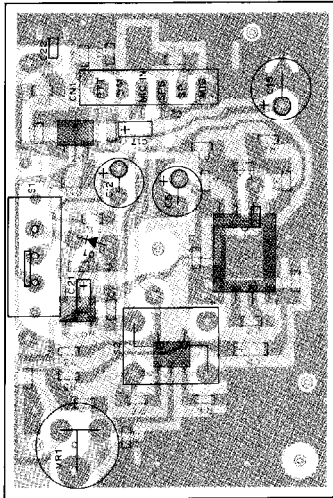
• Block diagram



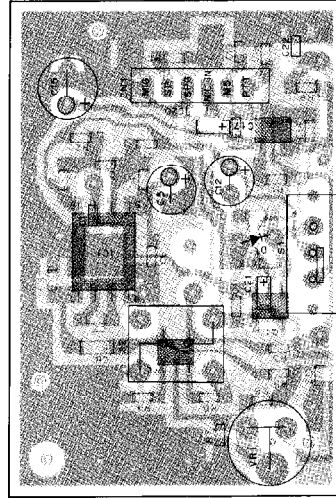
HMC-2 (HEAD SET WITH VOX & PTT)

HMC-2 PC BOARD VIEWS

Component side view



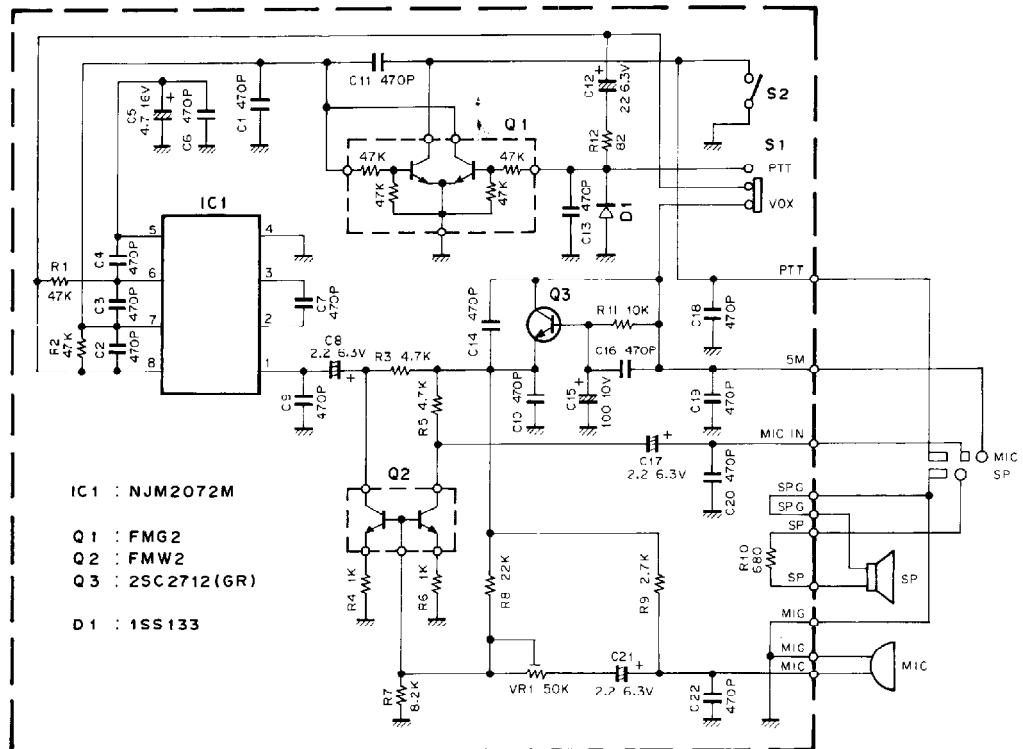
Foil side view



Component side

Foil side

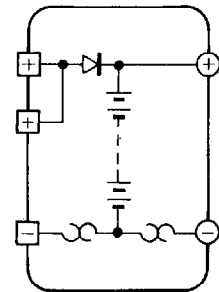
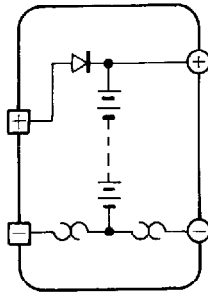
HMC-2 CIRCUIT DIAGRAM



TH-25A/AT/E

PB-5/6/7/8/9 (Ni-Cd BATTERY)

PB-5 EXTERNAL VIEW PB-5 CIRCUIT DIAGRAM PB-7 EXTERNAL VIEW PB-7 CIRCUIT DIAGRAM



PB-5 SPECIFICATIONS

Electrical characteristic

Voltage 7.2V (1.2V x 6)

Charging current 200mAh

Dimensions 58 W x 36.5 (39.5) H x 29.5 D (mm)

Weight 80g

PB-7 SPECIFICATIONS

Electrical characteristic

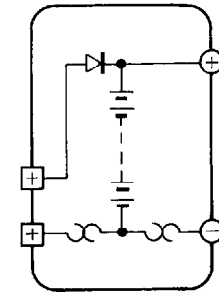
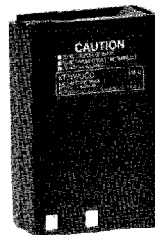
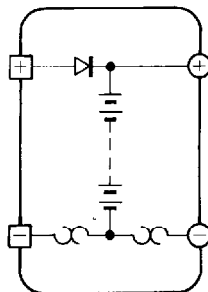
Voltage 7.2V (1.2V x 6)

Charging current 1100mAh

Dimensions 58 W x 98.5 (101.5) H x 29.5 D (mm)

Weight 300g

PB-6 EXTERNAL VIEW PB-6 CIRCUIT DIAGRAM PB-8 EXTERNAL VIEW PB-8 CIRCUIT DIAGRAM



PB-6 SPECIFICATIONS

Electrical characteristic

Voltage 7.2V (1.2V x 6)

Charging current 600mAh

Dimensions 58 H x 55.5 (58.5) H x 29.5 D (mm)

Weight 180g

PB-8 SPECIFICATIONS

Electrical characteristic

Voltage 12V (1.2V x 10)

Charging current 600mAh

Dimensions 58 W x 84 (87) H x 29.5 D (mm)

Weight 270g

PB-5/6/7/8/9 (Ni-Cd BATTERY)

PB-9 EXTERNAL VIEW



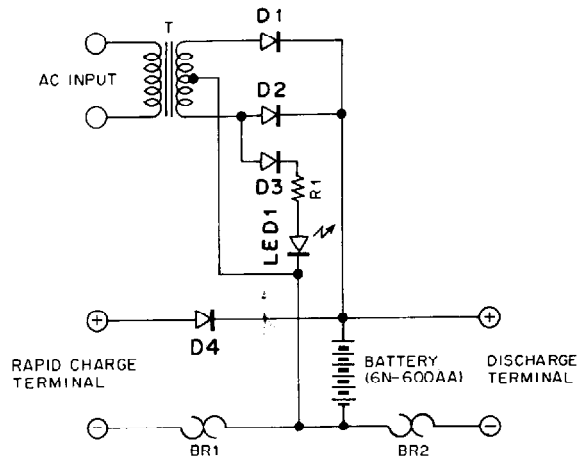
PB-9 SPECIFICATIONS

Electrical characteristic

Voltage	7.2V (1.2V x 6)
Charging current	600mAh
Charging input	AC 100 to 120V, 50/60Hz, 2.2W
Charging output	DC 8.0V, 100mA
Charging time	Approx. 10 hours

Dimensions	58 W x 98.5 (101.5) H x 29.5 D (mm)
Weight	260g

PB-9 SCHEMATIC DIAGRAM



PB-5/6/7/8/9 CHARGING TIME

Battery Charger	PB-5	PB-6	PB-7	PB-8	PB-9
BC-9	15	30	15	8	8
BC-10	8	8	15	8	8
BC-11	1	1	1	1	1

Unit : Hour

TH-25A/AT/E

SC-14/15/16 (SOFT CASE)/SMC-31 (SPEAKER MICROPHONE)

SC-14 EXTERNAL VIEW



with PB-5.

SC-15 EXTERNAL VIEW



with PB-5.

SC-16 EXTERNAL VIEW



with PB-7, 8 or 9.

SMC-31 EXTERNAL VIEW



SMC-31 SPECIFICATIONS

Electrical characteristic

• Speaker

Diameter	φ45 (mm)
Impedance	8Ω
Rated input power	0.15W
Max. input power	0.3W

• Microphone

Sensitivity	66dB ± 3dB at 1300Hz
Output impedance	2kΩ ± 30% at 1000Hz

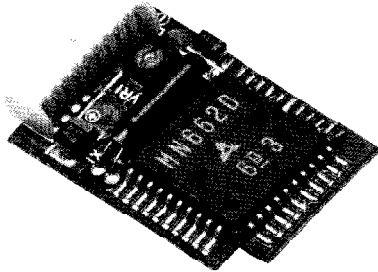
SMC-31 PARTS LIST

* : New Parts

Ref. No.	New Parts	Parts No.	Description
	*	D10-0605-08	PTT lever
	*	E30-2110-05	Cord ass'y
		J19-1360-08	Clip
		T07-0219-08	Speaker
		T97-1024-08	Microphone

TSU-6 (CTCSS UNIT)

TSU-6 EXTERNAL VIEW



TSU-6 PARTS LIST

* : New Parts

Ref. No.	New Parts	Parts No.	Description
CTCSS UNIT (X52-3100-00)			
C1		CK73FB1H102K	Chip C 1000pF K
C2		C92-0010-05	Tantal 6.8μF 6.3WV
C3	*	C92-0006-05	Tantal 3.3μF 4.0WV
C4, 5		CK73EB1E104K	Chip C 0.1μF K
C6		CK73EB1H223K	Chip C 0.022μF K
C7		CK73EB1E104K	Chip C 0.1μF K
C8, 9		CC73FCH1H150J	Chip C 15pF J
C10		CK73FB1H102K	Chip C 1000pF K
C11		CK73EB1E104K	Chip C 0.1μF K
C12		C92-0507-05	Chip tan. 4.7μF 6.3WV
C13	*	C92-0510-05	Chip tan. 3.3μF 4.0WV
	*	E40-5121-05	Pin connector (10P)
X1		I 77-1313-05	X'tal resonator 4.194304MHz
R11-10		HK/3FB2A000J	Chip resistor
R12-14		RK73FB2A000J	Chip resistor
VR1	*	R12-3460-05	Trimming pot. 33kΩ
Q1		DTC144TK	Digital transistor
Q2		DTA114EK	Digital transistor
Q3		2SC2712(GR)	Chip transistor
IC1		MN6520	IC
IC2		MN4094BS	IC

TSU-6 FINE ADJUSTMENT OF TONE FREQUENCY

The tone frequency can be fine adjusted with an interval of 0.5% step over the range of 0 to +1.5%. Ground the T1 (pin 10) and T2 (pin 9) of IC1 to obtain the desired frequency.

	T1	T2
0%	X	X
+0.5%	O	X
+1.0%	X	O
+1.5%	O	O

O : GND, X : OPEN

Table 3

TSU-6 REFERENCE DATA

TH-25's condition and MN4094BS (IC2) relationship

CTCSS switch	TONE switch	TX/RX	MN4094BS terminal		
			Q5	Q6	Q1 ~ 4, 7, 8
OFF	OFF	TX	L	H	L
		RX	L	H	L
	ON	TX	L	L	See table 2
ON	OFF	RX	L	H	L
		TX	L	L	See table 2
	ON	RX	H	L	See table 2
		TX	L	L	See table 2
		RX	H	L	See table 2

Q1 ~ 4, 7, 8 : Tone frequency setting

Q5 : TX/RX switch for MN6520 (IC1). "H" : RX, "L" : TX.

Q6 : Power switch for MN6520 (IC1). "H" : OFF, "L" : ON.

Table 1

Tone frequency and MN6520 (IC1) relationship

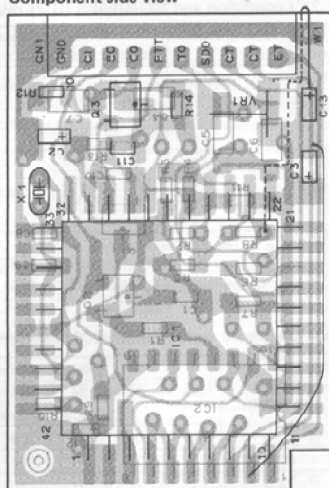
Tone frequency (Hz)	MN6520 terminal					
	S6	S5	S4	S3	S2	S1
	Q1	Q2	Q3	Q4	Q7	Q8
67.0	L	H	H	H	L	H
71.9	L	H	H	H	L	L
74.4	L	H	H	L	H	H
77.0	L	H	H	L	H	L
79.7	L	H	H	L	L	H
82.5	L	H	H	L	L	L
85.4	L	H	L	H	H	H
88.5	L	H	L	H	H	L
91.5	L	H	L	H	L	H
94.8	H	H	H	L	L	H
100.0	H	H	H	L	L	L
103.5	H	H	L	H	H	H
107.2	H	H	L	H	H	L
110.9	H	H	L	H	L	H
114.8	H	H	L	H	L	L
118.8	H	H	L	L	H	H
123.0	H	H	L	L	H	L
127.3	H	H	L	L	L	H
131.8	H	H	L	L	L	L
136.5	H	L	H	H	H	H
141.3	H	L	H	H	H	L
146.2	H	L	H	H	L	H
151.4	H	L	H	H	L	L
156.7	H	L	H	L	H	H
162.2	H	L	H	L	H	L
167.9	H	L	H	L	L	H
173.8	H	L	H	L	L	L
179.9	H	L	L	H	H	H
186.2	H	L	L	H	H	L
192.8	H	L	L	H	L	H
203.5	H	L	L	H	L	L
210.7	H	L	L	L	H	H
218.1	H	L	L	L	H	L
225.7	H	L	L	L	L	H
233.6	H	L	L	L	L	L
241.0	L	H	H	H	H	H
250.3	L	H	H	H	H	L

Table 2

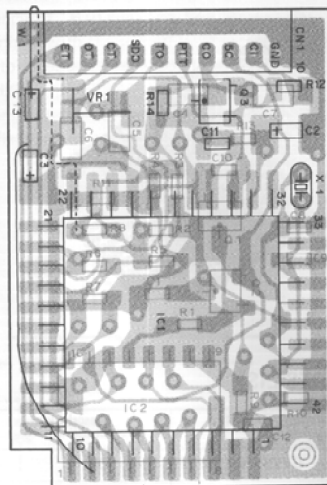
TSU-6 (CTCSS UNIT)

TSU-6 PC BOARD VIEWS

Component side view



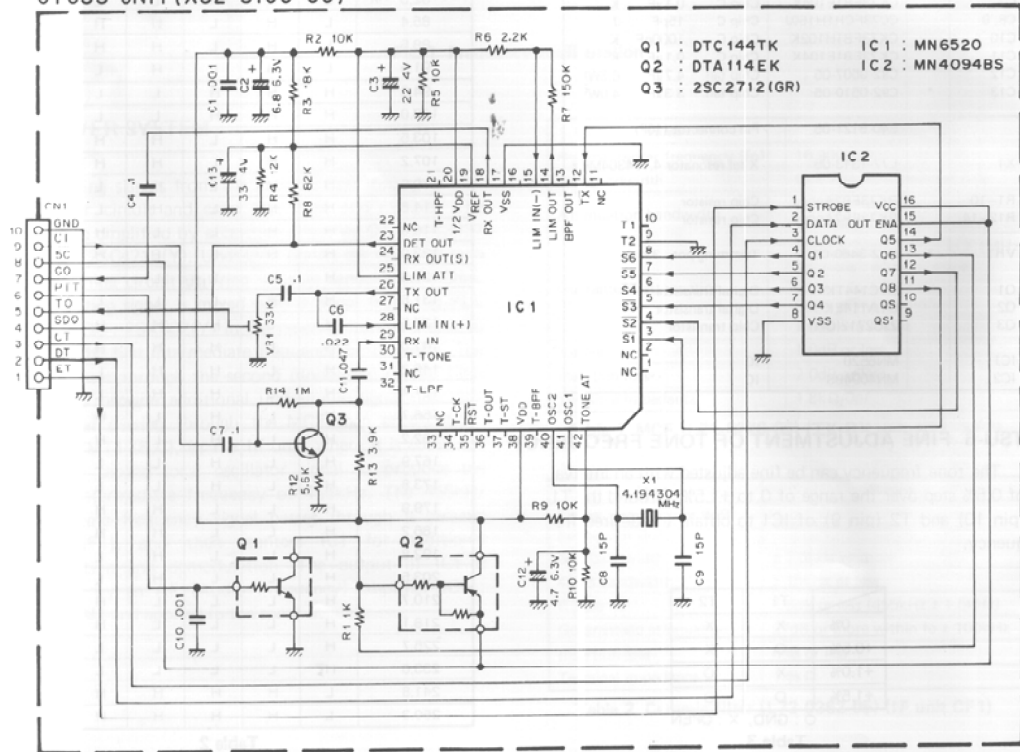
Foil side view



■ : Component side
■ : Foil side

TSU-6 CIRCUIT DIAGRAM

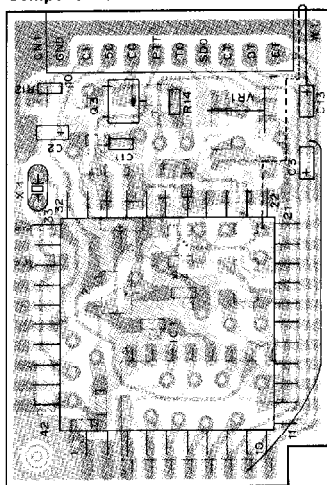
CTCSS UNIT (X52-3100-00)



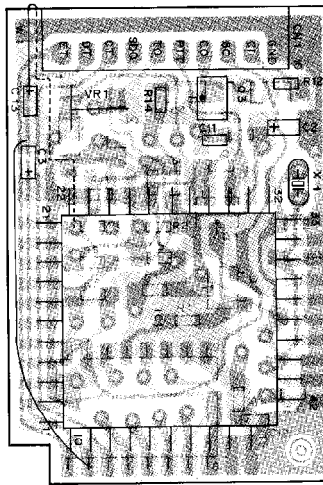
TSU-6 (CTCSS UNIT)

TSU-6 PC BOARD VIEWS

Component side view



Foil side view

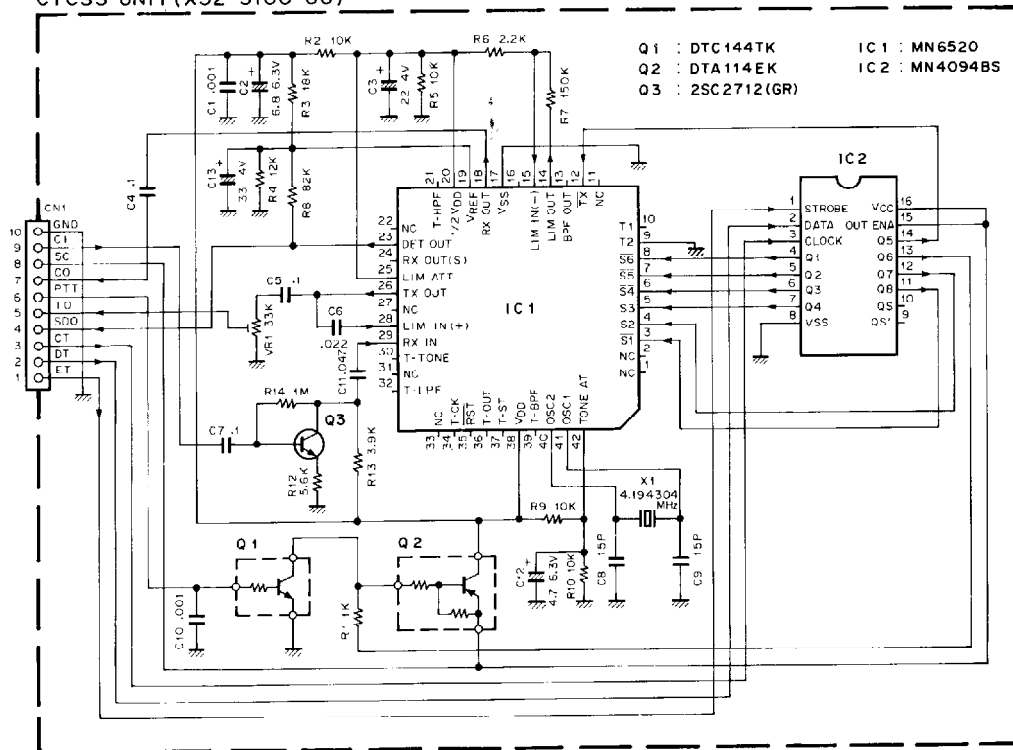


Component side

Foil side

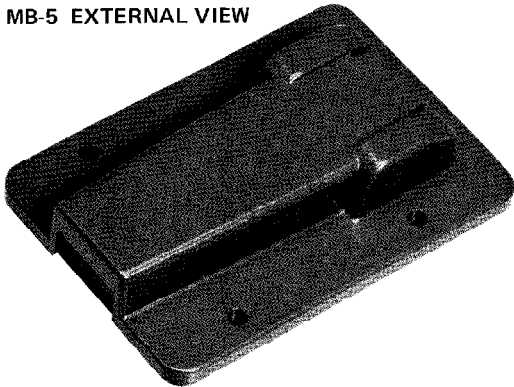
TSU-6 CIRCUIT DIAGRAM

CTCSS UNIT (X52-3100-00)

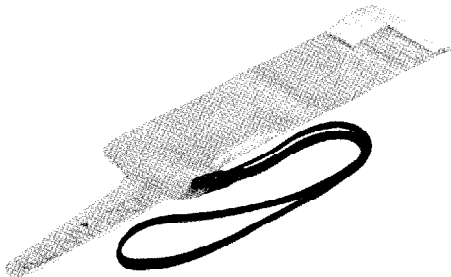


MB-5 (MOBILE BRACKET)/WR-1 (WATERPROOF CASE)

MB-5 EXTERNAL VIEW



WR-1 EXTERNAL VIEW



MB-5 PARTS LIST

* : New Parts

Ref. No.	New Parts	Parts No.	Description
	*	N99-0320-05	Screw set

Scan 3/1/02

ANTIQUES2
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SPECIFICATIONS

General

Frequency range	144.00MHz — 148.00MHz (TH-25A/AT) 144.00MHz — 146.00MHz (TH-25E)
Signal type	F3 (F3E)
Power supply voltage	DC 6V — 16V (DC IN jack)
Power consumption	At reception standby ; Approx. 55mA At battery power save ; Approx. 16mA At auto power off ; Approx. 6mA At transmission (5W) ; Less than 1.2A At transmission (0.5W) ; Less than 0.4A
Antenna impedance	50 Ω
EXT. MIC impedance	2k Ω
Operating temperature	20°C — +50°C
Dimensions	58 (68.5) W x 137.5 (152) H x 29.5 (34.5) D mm The numbers in the parenthesis include projections parts.
Weight	400g (including antenna and Ni-Cd batteries)

Transmitter section

Output power	Hi ; 5W, Low ; 0.5W
Modulation system	Reactance modulation
Max. frequency deviation	± 5 kHz
Unwanted reflection	Less than -60dB
Frequency tolerance	Less than $\pm 20 \times 10^{-6}$ (-10°C ~ +50°C)

Receiver section

Reception system	Double superheterodyne
Intermediate frequency	1st IF ; 16.3MHz 2nd IF ; 455kHz
Sensitivity	12dB SINAD ; 0.16 μ V
Squelch sensitivity	Less than 0.1 μ V
Selectivity	-8dB at more than 12kHz, -40dB at more than 28kHz
AF output	More than 200mW (8 Ω load, distortion 10%)

Design and specifications subject to change without notice.

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